CEREAL SCIENCE today

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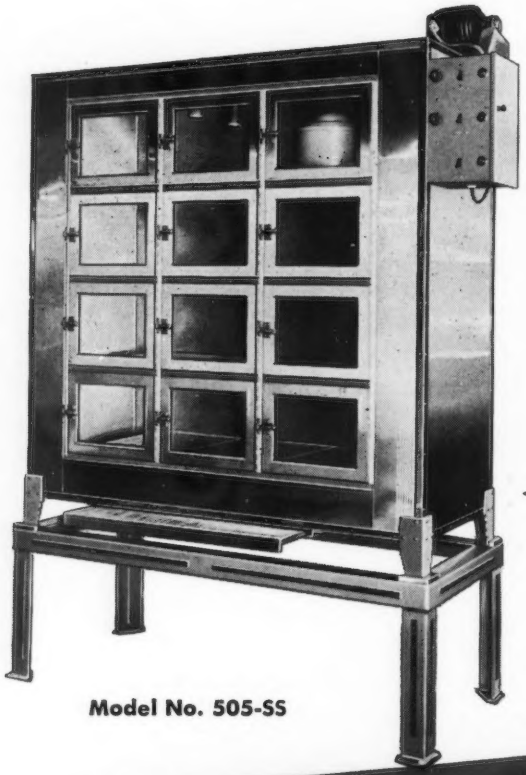

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The American Association of Cereal Chemists is devoted to: 1) the encouragement of scientific and technical research on cereal grains and their products; 2) the study of development and standardization of analytical methods used in cereal chemistry; 3) the promotion of the spirit of scientific cooperation among all workers in the field of cereal chemistry; 4) the maintenance of high professional standards of its membership; and 5) the encouragement of a general recognition of the value of the chemist and biologist to the cereal industries.

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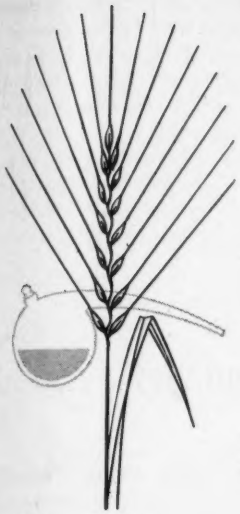

FEATURES

COVER: AACC'S President James W. Evans, American Maize-Products Co., Roby, Indiana

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editorial

LAST MONTH 533 cereal chemists came to Dallas for the 46th annual meeting of the American Association of Cereal Chemists. They came expecting big things in Texas; they were not disappointed. Only those who have personally participated in the planning and presentation of such a program can fully appreciate how far in advance the planning must begin and how many details require someone's attention.

Through such gatherings of people sharing mutual interests, an opportunity is provided to speed technological progress by communicating new knowledge in advance of publication. It is possible to learn, both through the formal program and informal discussions, where progress is being made and who are the authorities in specialized areas. In the past a common complaint has been that speakers may have known their material, but failed to get it across to their audience. It was gratifying to note that audience evaluation of the technical sessions at this meeting praised the excellence of most speakers' presentations. The consistently good attendance at technical sessions was further testimony, not only to the job done by the speakers, but to the excellent planning done by the Program Committee.

Progress was made in other ways, too. The Association voted to amend the by-laws to add a new class of membership; that of Associate Member. As Associate Members, technicians and students not able to qualify as Active Members, will be able to receive important benefits of AACC affiliation.

PAUL E. RAMSTAD

EDITOR'S NOTE: Dr. Majel M. MacMasters is the eleventh recipient of the Thomas Burr Osborne Medal, awarded by the AACC to distinguished scientists in the field of cereal chemistry. The medal was presented during the opening session of the 46th Annual Meeting at Dallas, Texas, May 10, 1961.

the Thomas Burr Osborne Medalist's address —

Implications of Kernel Structure

By Majel M. MacMasters

Department of Flour and Feed Milling Industries, Kansas State University, Manhattan[1]

ALL CEREAL CHEMISTS are, of necessity, interested in some phase of kernel structure; processing methods depend on structure and composition. Composition is dependent on structure, for composition differs from structure to structure, within the kernel. A brief review of the implications of structure to the processor may serve to show how fundamental a knowledge of kernel structure is to all consideration of operations in milling.

As we all know, the various cereal grains have much in common. All are single-seeded fruits of a specific type, which the botanist calls a caryopsis. From the standpoint of structure, the caryopsis of one cereal grain is similar to that of another.

The corn kernel may be taken as an example of a caryopsis. The seed itself is composed of three major structural parts, the germ, the endosperm, and the seed coat. These three parts are distinct from one another; i.e., there are no cell walls common to any two of them. The seed is surrounded by the fruit coat or pericarp. The pericarp is analogous to the pea pod, which is the fruit coat, in that case enclosing several seeds. In a caryopsis, the fruit coat adheres strongly to the seed coat of just one seed.

The wheat kernel is another typical caryopsis. The structure of the wheat kernel is more complicated, however, because a crease occurs from top to bottom of the kernel on the side opposite the germ. Also, some of the tissue of the nucellus, a structure that comprised much of the kernel in an early, immature stage, presists in the mature kernel as a thin layer just inside the seed coat. Otherwise, the wheat kernel is very similar to that of corn.

Kernels of other cereal grains resemble those of corn or wheat in not having or having a crease, and are very similar to both in other structural details. Some have nucellar tissue persisting at maturity, but others do not.

Most modern methods of milling cereal grains seek first to separate the kernel into three parts: bran, endosperm, and germ.

Bran Removal

Bran is an industrial term. It does not refer to a kernel structure. What constitutes bran depends on what type of milling is being done, and even then the word can be only approximately defined in terms of the structural components. The wheat flour miller wants to include in the bran all of the pericarp, seed coat, nucellar layer and aleurone cell layer of the wheat kernel. In corn dry milling, the bran ideally includes all of the pericarp (including the tip cap), the seed coat, and the aleurone layer. The corn wet-miller is not so concerned with removal of the aleurone layer, but otherwise the bran includes the same structures as in dry milling. Because no milling process is ideal, the desired separation is never perfect.

However, the miller does have certain advantages in the structure of the kernel that facilitate bran removal. The outermost cells of the pericarp are long, thin, and fiberlike, with thick cell walls. The cells hold tightly to one another. All of these characteristics tend to make it relatively easy to remove at least part of the bran in large pieces. Inner layers of the pericarp, however, are composed of cell layers that, in corn, have many intercellular spaces, and, in wheat, have intercellular spaces in some areas. The layers do tend to cling together, and the innermost one clings firmly to the seed coat. It is fortunate for the miller that these structural parts do tend to adhere to one another, for again the result is relatively large pieces of bran. The wheat pericarp is structurally weak at about its central layer. The outer portion is the "beeswing"; in corn, the entire pericarp is more apt to remain held together as it is removed. In all cereal grains, the innermost cell layer of the pericarp adheres strongly to the seed coat. The seed coat is a very thin membrane, but it is continuous around the entire seed, except at one place. In the crease, or at the base of the kernel, there is some partially lignified tissue that is continuous with the seed coat. This tissue sealed off the entrance to the kernel at maturity. In wheat, it is known as the pigment strand and runs the length of the crease. In corn, it is the hilar layer which is visible at the base of the kernel when the tip cap is removed. When a kernel contains

[1] Contribution No. 366.

nucellar tissue at maturity, as does wheat and sometimes sorghum, for example, the seed coat adheres on its inner surface to the nucellar layer. Either the seed coat or the nucellar layer, when it is present, adheres to the aleurone cell layer which lies beneath it. These various layers of the bran therefore tend to be separated together in relatively large pieces.

The inclusion of the aleurone layer in the bran presents a special problem. The aleurone cell layer is, structurally, the outermost layer of the endosperm. In other words, there is no structural discontinuity between the aleurone layer and the rest of the endosperm, which the miller calls simply "endosperm." This is known to the botanist as the starchy endosperm and it is from this that flour, grits, or starch is produced. Instead of having to separate two structures, therefore, the miller is faced with the problem of breaking a structure where desired. All starchy endosperm cell walls would, ideally, be broken just beneath the aleurone layer. This ideal operation is all the more difficult to perform mechanically because the aleurone cell layer is not smooth on its inner surface. Some cells extend farther into the starchy endosperm than others. Sometimes the layer is more than one cell in thickness, but this circumstance does not, as a rule, greatly change the total thickness of the layer. Shearing the starchy endosperm from the aleurone layer is the aim in dry milling, and surprisingly good results are obtained.

It seems probable that both structure and chemical composition come to the aid of the processor at this point. It was found, some years ago, that the cell walls of the starchy endosperm of Pacific Northwest wheats are not of the same thickness and composition throughout the kernel. Thickness, at least, varies similarly in other soft wheats, some of the thinnest walls lying not far beneath the aleurone layer. If this is generally true in cereal grains, and if it is also generally true that thinner cell walls in this region contain less cellulose and hence may be structurally weaker than in other parts of the endosperm, the processor may be grateful to Nature for unexpected help.

Germ Separation

Nearly all modern processes of milling cereal grains have as one aim the separation of the germ as an individual fraction. That the miller can do this relatively well, again depends upon kernel structure: the germ is a structural unit.

There is, however, a complication. A thin layer of amorphous material, only a few microns in thickness, lies between the endosperm and the germ. This has been called the "cementing layer," because it apparently acts as an adhesive between the two structural parts: endosperm and germ. From its chemical nature and its position, the cementing layer appears to be composed of products resulting from the degradation of some adjacent endosperm cell walls. It is reasonable to suppose that the degradation occurred during the later stages of the development of the kernel. The presence of a layer of crushed, nearly empty endosperm cells adjacent to the cementing layer supports this view.

Either tempering the grain before dry milling, or steeping the grain in preparation for wet-milling, causes some increase in the water content of the germ. This swells the germ and probably tends to pull it away from the cementing layer. Possibly these treatments also somewhat soften the cementing layer and thus facilitate the separation. Any improvement in methods for obtaining a clean germ fraction must take into account the nature of the cementing layer, small and insignificant though the layer may seem. Even small structures may have large significance to the processor.

Other Effects of Moisture

No matter what type of milling, wet or dry, is used for processing a cereal grain, one early step is the introduction of more or less moisture. The amount of moisture with which the grain is treated depends on whether tempering for dry milling or steeping for wet milling is being performed.

What happens during tempering is usually described as "toughening of the bran and mellowing of the endosperm." The dry pericarp is brittle, in comparison with the same structure after it has absorbed additional moisture. Wetting the pericarp therefore increases the ability of the miller to remove it in relatively large pieces. Presumably, it is hydration of the cellulose and hemicellulose constituents of the pericarp that results in this desirable effect.

What is meant by "mellowing of the endosperm" is less evident. This is not to say that the results are not evident. But little is known as to the fundamental changes that take place when the endosperm is "mellowed." Milling is made easier and endosperm particles of the desired size and type are obtained, but the question remains: why? One thing that milling must do is to break cell walls in the starchy endosperm. The hypothesis may be tentatively advanced, therefore, that tempering makes the cell walls easier to break. Possibly a weakening of the resistance of the cell contents so that they do not "reinforce" the cell walls allows the full effect of shear during milling to be exerted on the walls. Perhaps, too, the cell walls are themselves decreased in strength, particularly those which are largely composed of hemicelluloses. It is hoped that work now in progress may lead to greater understanding of what changes occur during tempering and how they are effected.

What happens during steeping for wet-milling is better understood. Definite evidence has been developed to show that during the early stages of steeping, the lactic acid which is produced weakens the cell walls of the starchy endosperm, thus making them more easily broken during milling. Obviously, they must be broken before the starch, the primary end-product of the process, can be released from the cells. Later in the steeping process, the concentration of sulfurous acid is increased. Sulfurous acid is a reducing agent. It, like other reducing agents, has a specific dispersing effect on the proteinaceous material which surrounds each of the starch granules within each cell of the starchy endosperm. As the proteinaceous material is partially disintegrated by the sulfurous acid of the steep, the starch granules are freed. Their subsequent separation as relatively pure starch thus becomes possible. Here is seen the importance of relationships between

chemical components within the cell. If starch and protein were molecularly mixed, the processor would have a more difficult problem. But discrete starch granules lying embedded in a proteinaceous matrix are susceptible to separation.

Vulnerability of the Kernel

The cereal grain kernel seems particularly well protected from invasion from outside. The seed coat surrounds and protects the germ and endosperm, and the entire seed is, in turn, surrounded and protected by the pericarp. This "prepackaged" food and feed, capable of long "shelf-life," permitted our nomadic ancestors to settle down and to start the roots of our civilization.

Nature has given a great advantage to the cereal grain processor by furnishing him with raw material that is far less perishable than the materials processed by many other industries. But even cereal grains must be handled with care and understanding of their vulnerability to moisture, molds, and insects if products are to be of the highest quality.

It is evident to the processor that moisture can enter the kernel, and the grain handler has equal evidence at times that the kernel can be invaded by both insects and microorganisms. Structure is the protection of the kernel, but kernel structure has its vulnerable weaknesses.

The outermost cell layer of the pericarp is covered by a waxy cuticle that repels moisture and in other ways serves to protect the kernel from invasion. Naturally, this cuticle is lacking where the kernel was detached from the parent plant. The so-called attachment region (in corn, represented by the base of the tip cap) not only has no cuticle across the break, but is largely composed of tissue which contains many intercellular spaces. Entry of moisture, molds, insects, etc., is therefore relatively easy. The intercellular spaces of the attachment region are continuous with similar intercellular spaces in the inner portions of the pericarp. Thus a more or less continuous capillary system surrounds the seed. Moisture enters quickly; molds are often found within the pericarp, so they must enter fairly easily. The seed coat remains as the next barrier to the entry to endosperm and germ.

The seed coat is known to act as a semipermeable membrane; it greatly retards the entrance of many chemicals, such as wetting agents, while letting moisture through more readily. The seed coat also acts in some measure as a defense against insects and microorganisms.

When present, the nucellar layer presents an added obstacle to entrance into the kernel.

Finally, the aleurone cells form a continuous layer inside the seed coat, or inside the nucellar tissue when the latter is present. There are sometimes gaps in the aleurone layer in some areas over the germ. Except in these areas (when they are present), the walls of the aleurone cell layer must be traversed before anything from outside can effect final entry into starchy endosperm and germ.

Some or all of the protective layers are generally thinner over the germ than over other parts of the kernel. Molds and insects, therefore, have a relatively short distance to penetrate to the germ. The germ, moreover, is a softer tissue than the starchy endosperm of the mature kernel and hence is easier to enter.

Near the base of the germ there is a small area where the seed coat is thinner than anywhere else. This is the micropylar area, and is another place where water and molds apparently find relatively easy entry.

Expectations

The recent development of fine grinding and air-classification for industrial production of flour would obviously be impossible if the starch and protein within the contents of the individual starchy endosperm cells were not essentially separate entities. This is an example of the importance of the relationship of constituents within the cell. Other new industrial developments may be expected as more definite and detailed information is obtained relating kernel composition to structure. Some interesting and practical problems that have been attacked but on which additional work is needed include:

1. Changes in cell walls and cell contents that result from conditioning. Once the nature of desirable changes is established, control and improvement of conditioning methods can be carried out with some assurance of success.

2. Details of composition in relation to microstructure of the kernel. In this field, too, more information might lead to the development of new processing methods and the marketing of new products.

3. Relationship of flour particle characteristics to baking performance.

Much has been learned during the past fifty years as to the implications of kernel structure in the milling industries; and a goodly share of our present knowledge has already been put to use.

A great deal still remains to be investigated. No one knows what new methods and products may be based on the results of work that is as yet undone.

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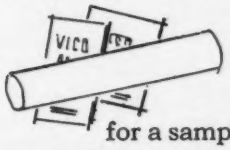

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to the AACC—1961

The Growth of Cereal Chemistry as a Profession[1]

By John A. Johnson[2]

Department of Flour and Feed Milling Industries,
Kansas State University, Manhattan

FORTY-SIX YEARS ago a small group of eleven chemists met at the Coates House in Kansas City, Missouri, to establish the American Association of Cereal Chemists. These chemists had been trained as analysts in the traditional way of that period. Of these eleven men, three are still members. They are Mr. C. F. Buck, Port au Prince, Haiti; Mr. A. R. Sasse of Brunswick, Missouri; and Mr. R. W. Mitchell of Evanston, Illinois. These men had common problems for which they sought solutions. Since then many of these problems have been solved and their solutions have been of material aid to developments in today's commerce in cereals, flour, and bread. These eleven men little realized that the organization which had such a modest beginning would someday be the largest of its kind in the world. They did not realize that from this would spring an organization of such diverse interests, and an organization ready and willing to meet new challenges.

When Was Cereal Chemistry Recognized as a Profession?

The profession of cereal chemistry developed gradually, and perhaps no one can say when it became recognized as a profession in America. Was it when men began to rely upon scientific measurements of quality differences in the cereals? Was it when the chemist with special interests in the complexities of cereals began to analyze and organize the facts and present them in an orderly fashion at meetings of local groups, at annual conventions, and in its journals? Was it when the chemist began to apply statistical principles to the measurements of such biological materials as cereals? Was it when books on cereal analysis first made their appearance? Was it when a few scattered universities offered courses to train students in this highly specialized branch of chemistry? Was it when the AACC's objectives were written into its constitution? Or had it arrived when technical committees began to bring about standardization of methods of analysis? These are only signposts along the way, indicating the height to which a profession may rise.

Growth of Profession Was Steady

Our growth as a profession has been steady over the years. This growth can be attributed to several factors.

The profession has never lacked problems, but neither has it lacked members who were willing to tackle them. These problems have created a constant challenge, an ever-changing scene. At first, mill and bakery chemists had to bring about agreement on protein, moisture, and ash analyses of the mill products. Such problems as these were solved in a very satisfactory manner, and the profession moved on to tackle other similar but more baffling ones.

Progress as a profession was possible also because devoted scientists of varied talents found outlet for their energies in the American Association of Cereal Chemists. In the complex, biological materials with which the chemist works, no other discipline of science such as mathematics, physics, or chemistry provided the necessary training for the solution of the problems. Indeed, these disciplines were essential, but to them were added the talents of the biologist, the bacteriologist, the pathologist, the physiologist, the statistician, the engineer, the economist, and the journalist. In essence, much healthy and vigorous hybridization of ideas and cross-fertilization of talents have taken place during the past 46 years.

The officers of the American Association of Cereal Chemists and the editors of its various publications deserve much credit for development of a professional spirit. So, also, do the Association's policy-setting and technical committees. Each individual who has served in these capacities has felt certain personal responsibility for the advancement of his profession. The Association has served as a focal point for the individuals.

One of the most important factors in professional growth of the Association has been its publications. The journals CEREAL CHEMISTRY, TRANSACTIONS, and CEREAL SCIENCE TODAY are to be found in almost every corner of the world. They have gained an enviable reputation and are found wherever there are problems of cereal utilization. Further, the Association has demonstrated maturity in the sponsoring and publishing of a series of monographs and laboratory manuals. Each monograph has demonstrated a certain mark of professionalism, and each has found its useful place in the libraries of professional cereal chemists. A third monograph is being written and will undoubtedly fill a void in literature concerning cereal technology.

The seventh edition of *Cereal Laboratory Methods* will be published soon under the auspices of the Association. This publication

[1] Presidential Address, 46th Annual Meeting American Association of Cereal Chemists, April 9-13, 1961, Dallas, Texas.

[2] Professor, Department of Flour and Feed Milling Industries, Kansas State University, Manhattan.

demonstrates a further stride in professionalism. The seventh edition will be a loose-leaf compilation of useful analytical methods, classified according to their reliability. The manual will be kept current by annual supplements. It should serve as a guide for analyses of all types of cereal products and the ingredients used by the cereal industries. Perhaps as important as application of the methods found in the manual to everyday laboratory problems has been the opportunity the technical committees provide for cereal chemists to have a focal point for each of the various problems that arise. The technical committees provide a means of communication by which cereal chemists can exchange ideas at a workable and effective level.

Continued Growth Depends on Action in the Future

A profession cannot rest on its past performance, however. Its continued progress and growth are dependent on individual members and what they do. There are numerous areas where professional growth can be enhanced. Many cereal chemists, in order to grow individually, need to become better informed on subjects within their own profession. The many technical training schools sponsored by the Association provide some opportunity for this. Cereal chemists need also to read much more widely, not only their own publications but also the publications of other associations and trades. A member who is well-read in all the areas which impinge on cereal chemistry inevitably is an informed member of society. He contributes immeasurably to the professionalism of any group.

The professional stature of an individual is measured not only by how well he is informed but even more by the publication of results of his own investigation, through which he shares information with his fellow-men. It is likely that many cereal chemists have room for improvement in this area. Frequently, the cereal chemist must convince management that he needs more time to prepare papers for publication. But first we must convince ourselves that we have information that should be shared with others, and that we have an obligation to our profession to spend the required time to prepare reports worthy of publication. Much research goes unheralded simply because it is unpublished. There is nothing quite so discouraging to a scientist as to do extensive research work and prepare a report for publication, only to find, in final review, that the facts he presents have been known by some individuals long before he started his own investigation. This is deplorable and inexcusable among professional people. Prompt publication of discovered facts is the only clear-cut solution.

As a professional group, cereal chemists have the responsibility of furthering the public acceptance and appreciation of cereal products and, more specifically, that of intensifying the role which cereal chemistry plays in bringing better and more wholesome products to the consumer. We need to co-operate more closely with trade journals and newspapers and other media, so as to keep the general public informed as to our contributions. Research work is never complete until it has been published and finds application in some human endeavor. We must challenge those who write disparagingly of the value of cereal foods in the daily diet. Our greatest weapon against those who would be derogatory is an enlightened public.

A Need Exists for University-Trained People

One of the handicaps in the development of cereal chemistry as a profession has been that few colleges and universities have seen fit to support a full-fledged program of training leading to the B.S. and advanced degrees in cereal chemistry. Public and private support, at times, has been meager. This, in part, has been true because no professional group, such as the American Association of Cereal Chemists, has demanded that universities provide this special training. Many students of science have drifted into the profession of cereal chemistry because their training in some discipline of science could be applied to cereals. We need to encourage some of our universities to provide facilities and faculties for the training of cereal scientists.

But to have universities equipped to train students of cereal science is of no avail unless young men and women are told of the opportunities for the cereal chemist. This is our responsibility. We, as cereal chemists, should be proud of our profession and positive in our approach to young people. We must talk about the "glamorous" aspects of the profession and about the advantages of being a cereal chemist. If the profession has any ills, let us discuss them among ourselves, let us gather data on these ills as in a scientific investigation, and then seek a solution. Let us do all we can to pass on the good heritage which is ours. Let us do all we can to promote the continued growth of the profession of cereal chemistry.

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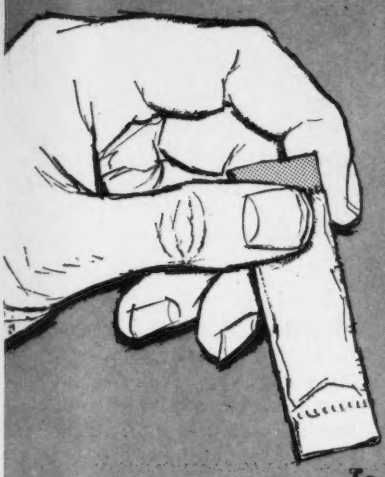

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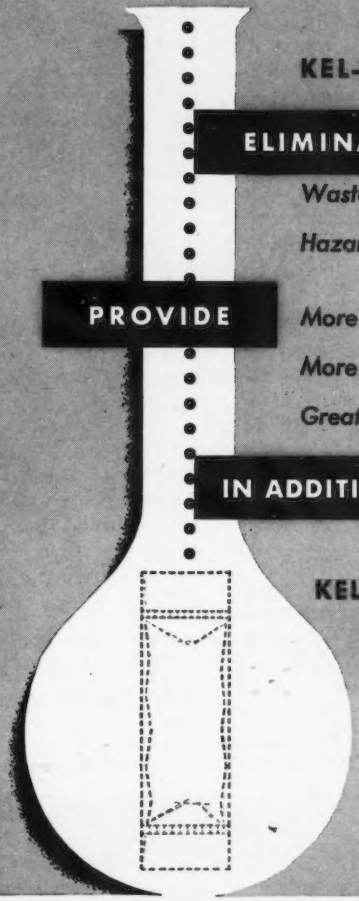

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AACC SCORES AT DALLAS MEETING

New officers and director of the AACC for the year 1961 to 1962. Left to right: S. F. Brockington, Director — Quaker Oats Co., Barrington, Ill.; Byron S. Miller, Secretary — Kansas State University, Manhattan; James W. Evans, President — American Maize-Products Co., Roby, Indiana; Marjorie A. Howe, Treasurer — Russell Miller-King Midas Milling Co., Minneapolis, Minn; Majel M. MacMasters, President-Elect — Kansas State University, Manhattan.

THE AMERICAN ASSOCIATION OF Cereal Chemists scored two direct hits in its 46th Annual Meeting in Dallas. Both the technical program and local arrangements were outstanding as evidenced by standing room only in the technical sessions and larger than estimated crowds at the social events.

The week of April 9-13 saw some 533 chemists register, accompanied by 125 wives. The President's Reception on Sunday evening got things off to the right start. Monday morning was the opportunity to honor and recognize individual members of the Association at three special events, the presentation of the Osborne Medal; the election to Honorary Membership of six distinguished members of the AACC; the first presentation of the William F. Geddes Memorial Award for outstanding service to the Association. This award will be made annually.

Monday night the members and their wives and children were driven out to a dude ranch near Dallas to participate in a real Texas Style Bar-B-Que and Rodeo. The food was great, the music lively, and the rodeo entertaining. Semi-drag races between several of the bus drivers added to the evening's excitement.

The ladies were shown the sights of big "D" and attended daily luncheons courtesy of Durkee Famous Foods, Merck & Co. and Wallace and Tiernan. Plenty of time was allowed for individual shopping and renewing of friendships.

For the first time in a number of years the AACC used program evaluation cards during its technical sessions. The information thus gathered will be used as a guide for the program chairman at next year's meeting. The following individuals received the highest scores for the best technical presentation at each of the 12 sessions: Norman E. Foster, William A. Hardwick, F. H. Tinkler, F. R. Senti, Harry J. Konen, D. B. Pratt, Jr., Edna Montgomery, Edward F. Seeborg, C. E. Stauffer, Byron S. Miller, and K. E. Holt. Congratulations to these individuals for a job well done.

On the following pages you'll see pictures taken during the meeting and at some of the social events. Space limitations prevent the use of every picture taken, but the editor has tried to get in as many different faces as possible.

If you were at the meeting, now's the time to reminisce. If you didn't make it, plan now for 1962 in St. Louis.

Three outstanding events during the Monday morning opening session: President John A. Johnson confers honors and congratulates the recipients. At the left, Mrs. W. F. Geddes accepts the William F. Geddes Memorial Award for exceptional leadership and service to the AACC, awarded posthumously to her late husband, Dr. W. F. Geddes. • In the center picture R. Wallace Mitchell, charter member of the AACC, and R. C. Sherwood, Vice President and Technical Director of Sterwin Chemicals, are congratulated on their election to honorary membership. • At the right, Dr. Majel M. MacMasters receives the Thomas Burr Osborne Medal for her distinguished contributions to cereal chemistry.

Upper left. Paul E. Ramstad, General Mills, Inc., Minneapolis, Editor of CEREAL SCIENCE TODAY, and Norman Foster, U.S. Food and Drug Administration, Dallas, give close attention to Ralph Durr, Ingman Laboratories, Minneapolis.

Upper right. AACC members whirl their partners in a gay wind-up of Monday night's barbecue and rodeo, at Austin's Patio Ranch near Dallas.

Edith A. Christensen, USDA, Grain Division, Beltsville, discusses committee problems with the newly appointed Editor of CEREAL CHEMISTRY, Kenneth A. Gilles, North Dakota State University, Fargo.

Stuart B. Hughes and Ben Grogg, both of Quaker Oats Co., Barrington, Ill., catch up on noteworthy points from the cereal technology session.

Bottom right. Left to right, James L. Lamkin, Hunter Milling Co., Wellington, Kansas; C. S. Sullivan, Wm. Kelly Milling Co., Hutchinson, Kansas; Donald W. Hatch, Campbell-Taggart Associated Bakeries, Dallas; and John W. Giertz, The Kansas Milling Co., Witchita, Kansas.

A. G. O. Whiteside, Central Experimental Farm, Ottawa, Ontario, and T. R. Aitken, Grain Research Laboratory, Winnipeg, Manitoba, compare notes on Canadian wheats.

STERWIN CHEMICALS, INC. • Left to right, Victor Marx, Secretary Emeritus, ASBE; R. Wallace Mitchell, American Institute of Baking; and Robert F. Light, Standard Brands, Inc.

UNITED SALT CORP. • Left to right, A. Gordon O. Whiteside, Canada Dept. of Agriculture; Burney Johnson, United Salt; Fred Ward, National Dairy Products Corp.

FRIES & FRIES, INC. • Left to right, Lois Smart, Ralph W. Smart, Fries & Fries, Inc.; Roderick J. West, Fries & Fries; William H. Finley, Swanson's Cookie Company; Henry Allen, Gerber Products; Merrill J. Gross, Fries & Fries; Paula J. West, Fries & Fries.

HEGMAN, INC. • Doyle C. Udy, Udy Analyzer Company; Martin Wise, Centennial Mills; Glen Jones, Hegman, Inc.

C. W. BRABENDER INSTRUMENTS, INC. • Left to right, Mrs. C. W. Brabender, C. W. Brabender Instruments, Inc.; Norton W. Risdal, Russell Miller-King Midas Milling Co.; Ralph H. Durr, Ingman Laboratories.

AMF, UNION MACHINERY DIVISION • Left to right, James G. Pierce, Walnut Grove Products Co.; Joseph Daily, Edward Hayes, George Trum, AMF; William Eichenberger, A. E. Staley, Inc.

ENCYCLOPAEDIA BRITANNICA • Left, Paul Snyder; right, O. J. La Fevers, Encyclopaedia Britannica, Inc.

FOOD INDUSTRIES CO. • Left, Ed Vaupel, Food Industries Co.; right, John T. Watson, Anheuser-Busch Inc.

POPE TESTING LABORATORIES • Fred C. Ward, National Dairy Products Corp.; Charles A. Becker, Sheffield Chemical; Winnifred Hunter, Pope Testing Laboratories.

MERCK & CO. • Left to right, John J. Hegyes; Paul Hammes, B. Wayne Carmichael, and Paul A. Weeke, Merck & Co.

EASTMAN CHEMICAL PRODUCTS INC. • Left to right, Neil Danehy and William J. Simcox, Distillation Products Industries; E. Richard Sherwin, Eastman Chemical Products; Robert B. Kilborn, The Wheatena Corp.

COULTER ELECTRONICS • Shepard Kinsman, Coulter Electronics; Ralph S. Terrell, The Pillsbury Co.

William C. Shuey, General Mills, Inc., Minneapolis, and Grant R. Astleford, Russell Miller-King Midas Milling Co., Minneapolis, discuss the progress of farinograph standardization.

COLEMAN INSTRUMENTS, INC. • Left to right, Ralph S. Terrell, The Pillsbury Co. and J. C. Elkins, Coleman Instruments, Inc.

CHAS. PFIZER & CO., INC. • Left to right, John Kauffman; John E. McVeigh and Bob Knoebel, Chas. Pfizer & Co.

Joe Elward, Atlas Powder Co., Chicago, and Robert W. Bates, Armour & Co., Chicago, relax and chat between sessions.

Left, Paul E. Tack, Jewel Tea Co., Barrington, Ill., compares notes with two men from International Flavors and Fragrances: Paul Orsay, middle, Elizabeth (N.J.) office, and Richard J. Hale, right, Chicago office.

Larry Marnett, C. J. Patterson Co., Kansas City, Mo. (left) and Howard Becker, Nebraska Consolidated Mills Co., Omaha (right), were interrupted while discussing mutual problems.

O'Dean Kurtz, U.S. Food & Drug Administration, Detroit (left), exchanges banter at the President's Reception Sunday night with Kenneth L. Harris (center), FDA, Washington, and Glenn E. Findley (right), Burrus Mills, Dallas.

Top right: Three members of the Dallas Local Arrangements Committee pause for a moment's relaxation. Left to right: George E. Tate, General Mills, Inc., Wichita Falls, Texas, Registration Chairman; Cato Christensen, Publicity; and Hugh J. Fetty, American Foods, Inc., Dallas, Chairman.

Orville Weislogel and Herbert C. Smith, both of Northern Regional Research Laboratories, Peoria, Illinois, enjoying a break in the program.

Norman E. Lloyd, Clinton Corn Processing Co., Clinton, Iowa, newly appointed member of the AACC's Board of Directors, compares notes on the starch session with Thomas J. Schoch, Corn Products Co., Argo, Ill.

Bottom right. Incoming President James W. Evans, American Maize-Products Co., Roby, Indiana (right), receives the gavel from retiring President John A. Johnson (left) during the installation ceremony.

Wilbur Claus, Carnation Research Center, Van Nuys, Calif. (lef), and Joseph V. Reger, Western Condensing Co., Appleton, Wis. (right), talk over technical problems.

STUDIES OF THE changes which take place during the storage of flour and other milled products have in many instances produced somewhat conflicting results. Saunders and co-workers (8), for example, reported flour had been stored for 14 years with little deterioration in quality. Likewise, Greer, Jones, and Moran (4) noted an instance of canned flour, 27 years old, which was apparently in good condition. On the other hand, McCalla *et al.* (6) in tests at room temperature and Cuendet *et al.* (2) in tests at slightly higher temperature have reported flour showing appreciable deterioration on storage for 3 months or even less.

It has been found that storage life of flour can be enhanced by reducing the moisture content below that at which the product comes from the mill. Yet the moisture must not be reduced too far, for below 5 to 6% the development of rancidity is accelerated (2). Off-odors develop more rapidly the higher the moisture content of flour (2), and there is a parallel development of off-flavors in the baked bread (4). An increase occurs in the acidity of the petroleum ether-extractable fats during the storage of flour (2), but there is evidence that this increase is not necessarily the cause of deterioration in baking strength (3,7).

a practical trial with hard spring wheat products — interim report on

Effect of Package Type on Stored Flour and Farina[1]

By R. K. Larmour[2] and J. H. Hulse[3]
Maple Leaf Milling Co., Toronto, Ontario
J. A. Anderson[4] and C. J. Dempster[4]
Grain Research Laboratory, Winnipeg 2, Manitoba

To add to the existing body of knowledge on changes occurring during storage of milled products, a long-term storage project was initiated in Canada more than 5 years ago. The study was essentially a practical trial to assess the effect of various types of packaging on the keeping quality of hard red spring wheat flour and farina when stored outdoors under very simple conditions such as might be encountered in an emergency. A number of package types were used, some of which included a barrier to retard interchange of both moisture and atmospheric oxygen in the material during storage. Packaging materials and the necessary associated handling equipment were limited to those commercially available, and the package types represented small sizes suited for individual family use as well as much larger sizes suited for bakery, canteen, or other semicommercial use. The flour and farina were stored at two moisture levels: the normal moisture of the product as it came from the mill, and a considerably lower level achieved by drying. In the main, the materials were stored outdoors on a rodentproof platform under a rainproof tarpaulin, but some control samples were also stored indoors at a constant temperature.

The inclusion of farina as well as flour in this study was attractive for several reasons. Farina can be used directly in the production of bread of excellent quality[5] and, more important, can also be used directly as a foodstuff simply by making a porridge. Because of a smaller surface area relative to flour, farina should be expected to have a longer storage life before going rancid, for example. Again, because of its larger particle size, farina could effect a saving in bulk volume in packing.

Samples representative of most of the storage conditions in the experiment have been removed from storage annually, and baking tests, together with a wide range of physical and chemical tests, have been carried out. The data to be presented in this paper constitute a progress report on the first 5 years of this storage study and summarize the highlights of the changes which have occurred to date. Sufficient material still remains in the storage stockpile to permit the investigation to be continued for several years.

Outline of Storage Experiment

Flour and farina were commercially milled from one lot of Canadian hard red spring wheat. The flour had 14.5% moisture, 0.44% ash, and 11.3% protein; the farina had 15.0% moisture, 0.35% ash, and 10.5% protein. Some of the flour and some of the farina were stored at their initial moisture levels; some of each was stored after having been dried to a lower level. Drying was effected in a pneumatic dryer by passing flour through twice and farina three times. Temperatures during drying did not exceed 125°F. in the flour and 135°F. in the farina. After drying and prior to packaging, the flour and farina were held at 0°F. (without any change in moisture) for 8 days to kill any possible infestation.

[1] Joint contribution of the Maple Leaf Milling Company, Toronto, Ontario, the Defense Research Medical Laboratories, Toronto, Ontario, and the Grain Research Laboratory of the Board of Grain Commissioners for Canada, Winnipeg, Manitoba. Paper No. 196 of the Grain Research Laboratory.
[2] Director of Research.
[3] Deputy Director of Research (formerly Head of Food Research, Defense Research Medical Laboratories, Toronto 12, Canada).
[4] Director and Chemist respectively.
[5] G. N. Irvine: unpublished observation.

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TABLE I. Outline of Storage Experiment

Package Type	Capacity, lb. Flour	Capacity, lb. Farina	Flour 8.0%	Flour 14.5%	Farina 10.0%	Farina 15.0%
MAIN EXPERIMENTS						
Standard packages						
Bags	100	100		O I		O I
Bales	7 by 7	6 by 7¾	O I	O	O	O
Cases	12 by 3	12 by 3½	O I	O	O	O
Barrier packages						
Bags	100	100	O I	O I	O	O
Bales	7 by 7	6 by 7¾	O I	O	O	O
Cases	12 by 3	12 by 3½	O I	O	O	O
Cans	32	40	O I	O	O	O
SUPPLEMENTARY EXPERIMENT						
Barrier packages						
Cans — N_2 pack	32	40	I	I		
Bags	100	100	O	O		
Fiber drum	125	140	O I	I	O	
Aluminum drum	175	200	O I	I	O	
Rubber drum	300	350	O I	I	O	

[a] O — stored outdoors; I — stored indoors.

An outline of the whole storage experiment is given in Table I. The twelve package types represented in the experiment are listed at the left, together with the storage capacity of each individual package. At the right, under column subheadings designating the initial moisture levels at which the flour and farina were placed in storage, the letters O and I indicate which package types were used for storage of flour or farina either outdoors or indoors. Flour and farina, at both normal and low moisture levels, were stored outdoors in most, but not all, package types; the materials in only a few of the package types were stored indoors at a constant temperature of 75°F. as controls.

The experiment has been divided into two sections: The main experiment consisted of sufficient material and packages to permit annual testing for 10 years; the supplementary experiment was intended for a much less frequent sampling. The main experiment was further subdivided into two subsections, the first grouping together the standard or permeable packages and the second comprising packages which embodied a more or less impermeable barrier material.

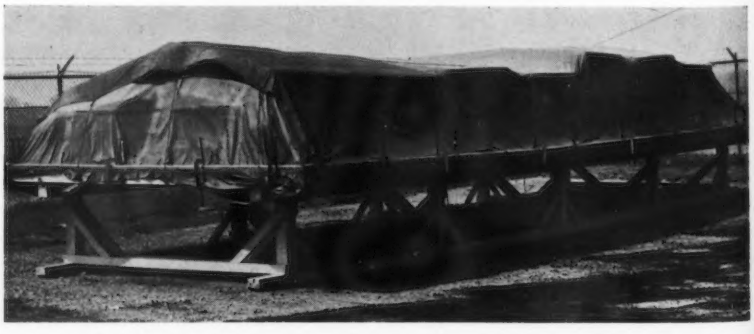
Each of the first three barrier packs was identical with the corresponding standard pack except for the inclusion of a laminated barrier material, inserted as an overwrap between the inner container and an outer covering. Thus the standard bag pack consisted of an inner cotton bag and an outer bag made of jute; the moisture barrier pack had the laminated barrier between the inner (cotton) and outer (jute) bags. The bales consisted of individual paper-bag containers in a double-wall paper bale with an outer wrapping of jute. In the barrier pack, the laminate, which was heat-sealed when once in place, was overwrapped between the paper and the jute bales. The standard case consisted of 12 paperboard cartons, each with a glue-tight wrapper, packed in a corrugated case which in turn was in a V-board outer case. In the barrier case, each paperboard carton was lined with a nonbarrier laminate of glassine/aluminum foil/glassine. The corrugated case containing twelve such cartons was overwrapped with the barrier material and the whole enclosed in the outer V-board case.

The cans of the main experiment were of 5-gal. capacity (10½ by 10½ by 13½ in.) with a 6-in. plug top. These and the packages of the supplementary experiment were, by nature of their construction, in effect barrier-type packages. Some cans of flour which had been flushed with nitrogen before sealing were included in the supplementary experiment to test the utility of such packing. The 100-lb. pack of this section of the experiment consisted of a cotton bag, a barrier of heat-sealed polyethylene only, and an outer cotton bag. The remaining containers simulated larger packages which, if suited, could serve to store flour and farina in large bulk. The fiber drums were totally lined with an unsealed polyethylene liner. The aluminum drums simulated commercial tote bins.

Storage out-of-doors was the condition of main interest in this experiment. As illustrated in Fig. 1, the outside storage conditions were quite simple, with the samples stacked on a large rodentproof platform, 13 ft. 6 in. by 42 ft., elevated 4 ft. off the ground. Each stack of samples was covered with a buffer layer of flour in 100-lb. bags, which in turn was covered with a wooden pallet. A waterproof tarpaulin covered the whole store and was securely fastened to the platform. Outdoor storage was in an unsheltered area on the grounds of the Defense Research Medical Laboratories in suburban Toronto, where the mean annual storage temperature is between 45° and 50°F.

It has turned out in this study that differences between individual types of package in their ability to prolong storage life are rather small, and that by far the greater factor is the presence of a barrier material. With one or two exceptions to be noted later, all samples of flour and all samples of farina in permeable packages have undergone essentially similar changes in most properties. The flours and

Fig. 1. The stockpile of materials stored outdoors.



farinas in barrier packages likewise have in general undergone parallel changes, but these are markedly different from those for the standard packs. For this reason, in the discussion to folow, it seems adequate to present results to illustrate the effects of the barrier material.

Moisture Changes

In this study, the most important factor affecting the storage life of flour and farina has been the moisture content of the material. Figure 2 presents data selected to show the general changes in moisture which have occurred during storage and the role that package type plays. Data are presented for flour only. Essentially parallel changes occurred for farina, but the rate of change was generally slower. The top two graphs show the change in moisture content for normal and dried flour, in barrier packs, stored indoors (left) and outdoors (right); the bottom two graphs show the changes which occurred when storage was in standard, permeable packages.

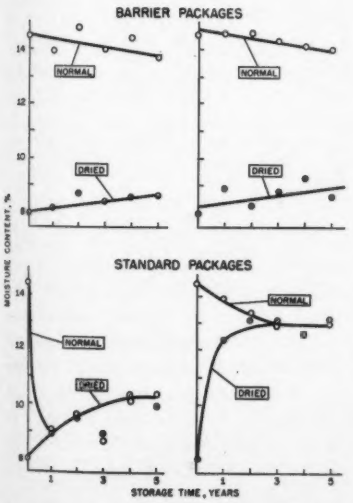


Fig. 2. Representative changes in moisture of normal (O) and dried (⊙) flour in barrier-type (top graphs) and standard packs (bottom graphs) for storage indoors (left) and outdoors (right).

The upper two graphs of Fig. 2 serve to illustrate that the barrier material is very effective in retaining the moisture content of flour and farina close to its initial value. Both low- and normal-moisture materials undergo slight and apparently linear changes in moisture during storage, and these were slower for farina than for flour.

The lower two graphs of Fig. 2 illustrate that both dried and normal flour, when stored either indoors or out in standard nonbarrier packs, undergo appreciable changes in moisture. Furthermore, the low- and normal-moisture samples attain a common moisture level which is much lower for the indoor storage. Normal flour stored indoors dried out very rapidly during the first year to the same moisture level as that attained by the dried sample. With subsequent storage, this common moisture level has fluctuated somewhat, but over-all has tended to increase, the level after 5 years being about 10%. For the materials in the standard packs stored outdoors, an equilibrium moisture level near 13% was attained after 2 to 3 years of storage.

It bears repeating, perhaps, that the presence of a moisture barrier was of far greater importance than any effect of package type *per se* in controlling the changes in moisture during storage. Differences between individual standard package types or between individual barrier package types were negligible.

Changes in Baking Strength

The main criterion for assessing the storage life of the materials in this experiment is the magnitude of the loaf volume when bread is baked using the malt phosphate modification of the AACC pup-loaf procedure. Throughout the 5 years of tests, an improver level of 5 p.p.m. of potassium bromate has been used in baking normal-moisture flour; all other samples were baked with no bromate. These levels represented the optimum improver dosages for the samples at the outset of the experiment. Samples of stored farina were reduced to flour fineness by the reduction rolls of an Allis-Chalmers laboratory mill before being subjected to baking or any other physical or chemical test, moisture content excepted.

Figure 3 shows data representative of the changes in loaf volume occurring with outdoor storage for both the dried and normal flour and farina in the main experiment. The moisture content of the stored material is the main factor in determining the rate at which changes in loaf volume take place during storage, and moisture content in turn is determined largely by the presence or absence of a barrier. The left-hand graphs of Fig. 3 show that dried flour and farina in barrier packages have retained full baking strength. Indeed, in most instances a slight but progressive improvement in volume has been observed. Conversely, the samples of normal-moisture flour and farina maintained near the initial moisture level in barrier packages exhibit a marked and apparently linear decrease in volume.

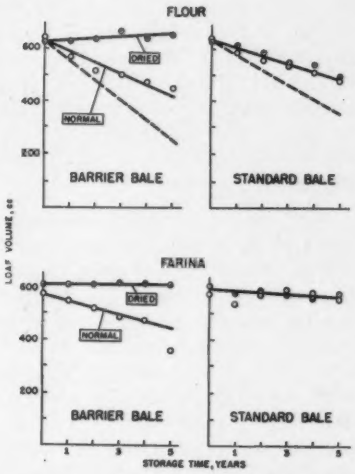


Fig. 3. Change in loaf volume during outdoor storage for normal and dried flour and farina in barrier-type and in standard bales.

The rate of both improvement and of deterioration is distinctly slower for farina than for flour. This is probably a consequence of differences in particle size but, as pointed out by Cuendet *et al.* (2), differences in the degree of refinement between flour and farina may also play a part.

The right-hand graphs of Fig. 3 show that flour and, to a much lesser extent, farina when stored outdoors in standard packages undergo a progressive deterioration in baking strength. The rate of deterioration appears to be independent of the initial moisture level for flour and again for farina. This, however, is not surprising, since both normal- and low-moisture flour and farina rapidly approach and eventually attain a common equilibrium moisture level.

Two package types contributed markedly to the deterioration of the packaged material. These were the 100-lb. barrier bag of the supplementary experiment and the standard case. The change in loaf volume for normal flour in the cotton bag with a barrier of polyethylene only is shown by the dashed line in the upper left graph of Fig. 3. However, dried flour in the same type of package followed the normal pattern for dried flour in barrier packs. The standard case, in which flour and farina were packed in unlined paperboard cartons, produced a more rapid rate of deterioration in volume for both flour and farina than that found for the other standard packs. For flour, this effect is illustrated by the dashed curve in the upper right graph of Fig. 3. The insertion of a laminated glassine liner, a nonbarrier material, between the flour or farina and the paperboard carton in the barrier case completely prevented the effect.

Brief mention should perhaps be made of the results for the samples stored indoors. Dried flour in barrier packages indoors fully retained baking strength over the 5 years of storage, whereas dried flour in standard packages and normal flour in both standard and barrier packages deteriorated progressively. The one sample of normal-moisture farina stored in a standard cotton bag began to deteriorate after 3 years. Differences between results for storage indoors and outdoors can be accounted for satisfactorily by the existing temperature differential. Thus, the deteriorative changes which have occurred have taken place more rapidly indoors where the temperature is about 17°F. higher than the mean outdoor storage temperature.

Perhaps the most important criterion to be considered in assessing the storage life of flour and farina is the development of off-odors and off-flavors in the stored material and especially in the baked bread, for it is of little consequence for flour and farina to retain baking strength as measured by physical properties of the loaf, if the odor or taste of the bread renders it completely unacceptable as a food. Accordingly, the flour and farina and a commercial-type bread made from all samples of both of these materials have been subjected annually to organoleptic tests to evaluate their suitability for food use. A rather wide range in odors and flavors has developed progessively during storage, and an attempt was made to assess at what point during storage odor and flavor changes had rendered the bread completely unacceptable.

Throughout the 5 years of storage, bread made from dried flour was always considered acceptable, although it is by no means free of foreign odors or tastes. Dried farina ranked next in its suitability for the production of acceptable bread. This behavior closely paralleled the loaf-volume performance of the flour and farina.

Pronounced off-odors in the products and off-flavors in the bread made from them developed in 2 to 3 years for the normal-moisture flour and farina in barrier packages, and this corresponded to a fairly pronounced decrease in loaf volume.

Changes in Fat Acidity and Fat

Figure 4 illustrates in general the changes which have been observed in this study in the acidity of the petroleum ether-extractable fats of the flours and farinas. In agreement with the results reported in earlier studies (2), changes in fat acidity are markedly dependent upon moisture content. Samples maintained at a high moisture content in a barrier package experience a much more rapid increase in fat acidity than samples maintained at a low moisture level. Particle size is also a factor, the increase being appreciably slower in farina than in flour.

The curves of Fig. 4 illustrate more or less the outside limits of the changes in fat acidity. Flour and farina in standard packages, where moisture levels have been attained which are intermediate between the high and low initial values, yield curves for fat acidity which are intermediate between those of Fig. 4.

A few samples have shown changes in fat acidity, the pattern of which differs from that shown in Fig. 4. One such curve, for the flour in the cotton bag with the polyethylene barrier, is shown at the left of Fig. 5. For this particular sample, which has undergone the most marked deterioration in loaf volume of all in the experiment, fat acidity increased at first, followed by a subsequent rather marked drop. The drop, however, is at least in part an artifact occasioned by the progressive decrease in the amount of petroleum ether-extractable fat in this sample, as shown by the right-hand graph of Fig. 5. A decrease in extractable fat accompanying storage has been noted only infrequently in previous studies (1,4,9).

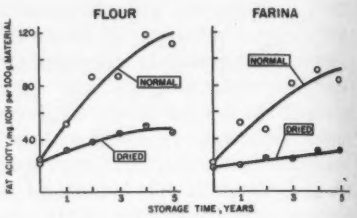


Fig. 4. Effect of moisture level on the development of fat acidity in flour and farina stored outdoors in barrier-type packages.

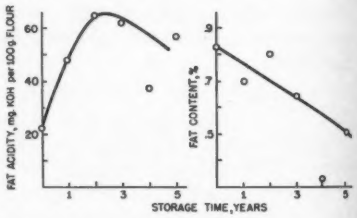


Fig. 5. Change in fat acidity (left) and fat content (right) in one flour, maintained near the normal moisture level in a barrier package.

The level of fat acidity in a given sample cannot serve as a reliable index of deterioration. For example, in this experiment, where the initial fat acidity level was about 20 mg. potassium hydroxide per 100 g. flour, pronounced deterioration in loaf volume has occurred at a fat acidity level as low as 38. On the other hand, a sample with a fat acidity of 69 has still fully retained its baking strength.

Changes in Lipoxidase Activity and Pigment Content

Occasionally it has been reported in the literature that a decrease in the pigment content of milled products takes place during storage (4,9). This observation has been confirmed in the present study. Moreover, it has been found that the lipoxidase activity of stored flour

and farina decreases. Figure 6 illustrates that the decrease in lipoxidase activity of both flour and farina is more rapid, the higher the moisture content and the finer the particle size. Some, but by no means all, of the samples maintained at normal moisture actually attained zero lipoxidase activity after 3 or more years of storage. It is noted in passing that marked decreases in lipoxidase activity of stored wheat have recently been reported by Russian workers (10).

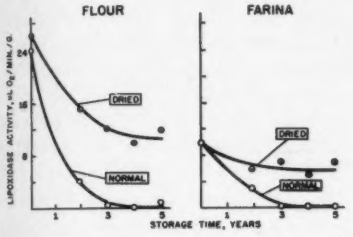


Fig. 6. Effect of moisture level on the lipoxidase activity of flour and farina stored outdoors in barrier-type bags.

The loss of pigment during storage depends to a considerable extent upon the residual lipoxidase activity. Thus, the dried samples in barrier packages which have the slower change in lipoxidase activity tend to experience a more rapid loss of pigment. The range of both pigment and lipoxidase activity values encountered in flour and especially in farina is not sufficiently wide to permit these characteristic changes to serve as indices of the onset of deterioration in stored flour and farina.

Changes in Physical Dough Properties

Throughout the storage experiment, doughs prepared from the stored materials have been characterized by both the farinograph and the extensigraph. In many instances, rather marked changes have occurred in physical dough properties by both test methods, and these parallel the decrease in baking strength. The changes, however, were not precise enough to serve as a sensitive indicator of keeping quality.

Farinograms show the following general changes in dough characteristics: Dough development time decreases as deterioration progresses; farinograph absorption also has a general tendency to decrease. Farinograms for many of the samples undergoing deterioration develop a downward inflection, but in some instances other rather markedly different changes occur which at the moment cannot be explained in terms of moisture differential.

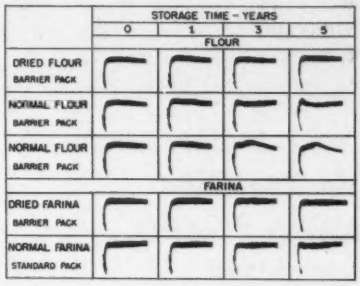


Fig. 7. Farinograms illustrating changes in flour and farina during storage.

Figure 7 shows farinograms obtained initially and after 1, 3, and 5 years of storage for certain of the stored samples. These curves were selected to portray the whole range of changes which have been observed.

Farinograms in row 1, for dried flour stored in a barrier package, a condition well suited to preserving baking strength, show a minimum of change in farinograph characteristics during storage; farinograms of row 2, for normal-moisture flour in a barrier pack, are representative of the rather general changes which accompany the progressive deterioration in flour during storage. However, another quite different type of change found to accompany deterioration is illustrated by the farinograms of row 3; this particular flour was the one experiencing the greatest change in virtually all properties during the course of storage.

The farinograms in rows 4 and 5 are for samples of farina. The dried farina has fully retained its baking strength, but the normal-moisture farina has progressively deteriorated.

Extensigraph tests on the stored materials have been made on unleavened doughs made with 1% salt and 30 p.p.m. potassium bromate. Doughs were mixed in a GRL mixer (5) for 2.5 minutes, and curves were obtained by stretching doughs after 45 minutes and also after 180 minutes. Generally, increases in resistances to extension coupled with decreases in extensibility have occurred with storage. These changes are affected by temperature (being more rapid for indoor storage), by particle size (being slower for farina than for flour), and by moisture content (being somewhat more rapid for normal-moisture samples maintained near the initial moisture level).

The extensigram indices for the dried materials stored in standard packs showed some evidence of an accelerated, apparently anomalous rate of change in dough properties. Thus the increase in resistance to extension accompanying storage was slightly more rapid for dried rather than normal-moisture flour and farina. It may be that the drying of the flour and farina at the outset of the experiment has to some slight extent accelerated their natural aging. The conditions necessary for this accelerated rate of change have not been uniquely defined in this experiment, for the dried materials have had access to atmospheric oxygen and additional moisture as well.

Other Tests

During the course of the storage experiment, some other properties of flour and farina have been observed annually, and while some properties tend to change more or less markedly during storage, none seems to offer promise as a sensitive indicator of the keeping quality or storage life of stored flour or farina.

Gassing power and diastatic activity decrease during storage – gassing power showing the larger change. The wet gluten content of unleavened doughs shows a very marked decrease on storage, but of course this determination is subject to a rather wide error. The determination of amino acid nitrogen by the Sorenson method showed little or no change for the majority of samples. Flour acidity determination made on the water extracts used in the Sorenson amino nitrogen test, while showing some rather wide fluctuations, suggested that higher moisture materials did indeed increase.

Summary

Flour and farina, commercially

milled from one lot of Canadian hard red spring wheat, have been stored for 5 years in a variety of packaging materials to assess the degree of protection the package afforded to keeping quality or storage life. Samples at two initial moisture levels, 8.0 and 14.5% for flour and 10.0 and 15.0% for farina, were stored outdoors under simulated emergency conditions at a mean annual temperature of 45°–50°F. Some control samples were stored indoors at a constant temperature of 75°F.

All packages having a barrier to retard moisture interchange have maintained dried flour and dried farina in good condition; in many instances slight progressive increases in baking strength were noted. Conversely, moisture-barrier packages contributed to a fairly rapid deterioration in baking strength of normal-moisture flour and, to a lesser extent, normal-moisture farina.

In moisture-permeable packages, normal-moisture and dried farina underwent only a very slight decrease in baking strength, while normal-moisture and dried flour underwent an appreciable and progressive decrease.

Changes in many of the physical and chemical properties of the flour and farina have been noted during storage, but none seems suited to the prediction of the onset of deterioration in baking strength.

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THE YOUNG MAN or woman who wants a university degree in flour milling or cereal technology does not wonder where to go; the Department of Flour and Feed Milling Industries, Kansas State University, is unique in offering university degrees in these specialized fields. In fact, two curricula are offered to undergraduates in the department: Milling Technology and Feed Technology, each with options in Operation, Chemistry, and Administration. The options represent specialization in engineering, biochemistry, and business administration, respectively.

Most of the Department's faculty not only teach but also conduct research in the Kansas Agricultural Experiment Station. A few are on the staff of the USDA Hard Wheat Quality Laboratory, housed adjacently. This participation in research not only provides significant contributions to knowledge, but also makes for a well-balanced department that quickly incorporates current developments and latest research information in its courses.

Kansas State University's

Department of Flour and Feed Milling Industries

By Majel M. MacMasters and John A. Shellenberger

Department of Flour and Feed Milling Industries
Kansas State University, Manhattan[1]

The Teaching Program

The teaching staff is composed of highly trained specialists, including baking engineers, milling engineers, biochemists, bacteriologists, biologists, analysts, microscopists, and business administrators; all are experienced educators.

Courses required for the B.S. degree in Milling Technology or in Feed Technology are shown in the accompanying tables. Because the required courses are rigorous and basic, other universities readily accept them in transfer of credits. The student trained in Cereal Technology with the Chemistry option, for example, has the equivalent of a major in chemistry, and gains, in addition, a specialized knowledge of the biochemistry of cereal grains and their products.

Graduate work leading to the M.S. and Ph.D. degrees is offered in both Milling and Feed Technology. The emphasis, in either field, may be put on the engineering or on the biochemical aspect of the subject, as desired.

A number of scholarships, assistantships, and fellowships provide excellent opportunities for students to meet all or part of their educational expenses.

The industries recognize the value of the training given by the milling department. They generously lend support by providing funds for equipment, scholarships, and assistantships, and co-operation in research problems. In return, the industries profit by obtaining scientifically trained graduates. The Department always has more calls for its graduates, however, than it can fill. With new facilities now available, it will be possible to increase the number of students being trained and perhaps better meet the demand for them.

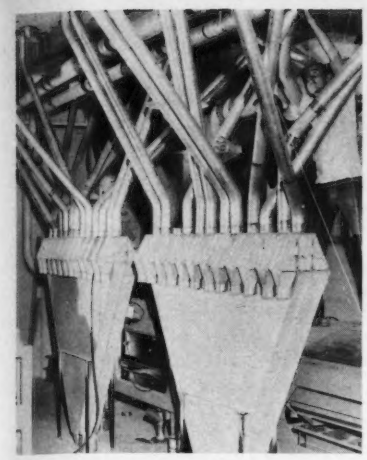
Large, well-equipped laboratories provide facilities for students to study experimental milling, experimental baking, physical properties of doughs, analytical methods applicable to cereal products (including paper, column, and gas chromatography, feed microscopy, and similar specialized techniques), biochemistry of cereal grains and their products, microscopic and physical characteristics, and engineering problems. Students in Milling Technology participate in the operation of a modern, complete 200-cwt. pilot flour mill. Those in Feed Technology obtain practical experience in a completely equipped feed mill which is in almost constant use.

Classrooms for lecture sections are conveniently provided in East Waters Hall, adjacent to the department's other quarters.

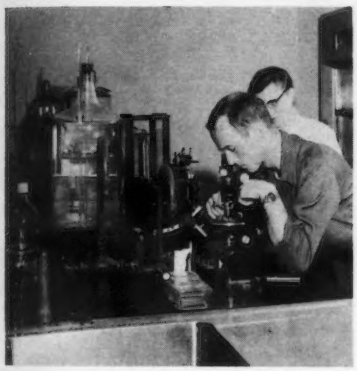
At present, there are 81 undergraduates majoring in Feed Technology and 37 majoring in Milling Technology. It seems inexplicable, considering the equipment and

Personnel of the Department of Flour and Feed Milling Industries and Federal Hard Red Winter Wheat Quality Laboratory.

[1] Contribution No. 363.



Scene during installation of spouting in the pilot flour mill. Special provisions have been made for sampling individual mill streams.



Part of one of the research laboratories where work is in progress to increase basic knowledge of cereal grain chemistry and processing.

other facilities available here and the positions that are open, that few students are interested in milling engineering.

At one time the Department was a part of the school of engineering, and graduates received the degree of Flour Mill Engineer; however, the program was abandoned for lack of students. The same situation was experienced years ago by Pennsylvania State College when it established a mill engineering school and more recently when the University of Minnesota provided a milling engineering option in the Department of Mechanical Engineering. These programs, too, were discontinued for lack of students.

The Research Program

It has been said, and many times repeated, that the first function of a university is to teach. Since advanced students learn best by applying their knowledge to problems in their fields of specialization, research is an integral part of teaching.

The Kansas State University milling department is especially fortunate in regard to research facilities. It has at its disposal both the feed mill and the pilot flour mill. These mills provide an opportunity for milling research that is unparalleled in educational institutions either in this country or abroad. With the pilot flour mill and the excellent facilities available for experimental milling and baking, it is possible to pursue research from the small-scale experimental stage through to the large-scale results, and thus to correlate laboratory findings with practical effects.

Equally good provisions have been made for research on the biochemical properties of cereal grains

Courses Required for the B.S. Degree in Flour or Feed Technology (Semester Hours)

FRESHMAN			
Agriculture in Our Society	2	Engineering Graphics	2
Chemistry	10	Psychology	3
Economics	3	Written Communications	6
Algebra and Plane Trigonometry	6	Air or Military Science	2
SOPHOMORE			
Principles of Milling	3	Air or Military Science	2
Flow Sheets	2	Option (see Table)	
Biology	8		
JUNIOR			
Milling or Feed Technology	4	Oral Communications	2
Quality of Wheat and Flour		Social Science	3
OR		Nutrition and Management of Farm	
Quality of Feed Ingredients	3	Animals (Feed Technology only)	4
Market Grading of Cereals	3	Option (see Table)	
SENIOR			
Milling Entomology	4	Civilization	6
Experimental Baking (Milling		Option (see Table)	
Technology only)	4		

NOTE: All students in the Department attend Agricultural Seminar and Milling Seminar, each, once a month without credit. All Freshmen are required to take two semesters of Physical Education, without credit. A total of 136 semester hours is required for graduation in Milling or Feed Technology.

Options (Semester Hours)

OPERATION			
Analytical Geometry and Calculus	12	Statistics	3
Engineering Graphics	4	Mechanics of Materials	3
General Organic Chemistry	5	Advanced Milling or Feed Technology	7
Engineering Physics	10	Advanced Flow Sheets (Milling Tech-	
Electrical Engineering	3	nology only)	2
Flour and Feed Mill Construction	3	Electives	7-11
CHEMISTRY			
Quantitative Analysis	4	General Microbiology	3
Organic Chemistry	10	Flour and Feed Analysis	4
Physical Chemistry	5	Advanced Wheat and Flour Testing	
Biochemistry	5	(Milling Technology only)	3
General Physics	8	Electives	4-9
Analytical Geometry and Calculus	12		
ADMINISTRATION			
General Organic Chemistry	5	Principles of Accounting	3
Quantitative Analysis	4	Business Law	3
General Physics	8	Sales Management	3
Flour and Feed Analysis	4	Business Organization and Finance	3
Grain Marketing	3	Statistics	6
Advanced Feed Technology		Business Letter Writing	3
(Feed Technology only)	4	Money and Banking	3
Labor Economics		Electives	8-9
(Milling Technology only)	3		

and cereal products, including feeds. Four large biochemical laboratories are supplemented by special rooms, including a darkroom, a sterile room for bacteriological work, a chromatography laboratory, a malting laboratory, and others. Research equipment of many types is available and is supplemented as required.

Equally adequate and well equipped are the research laboratories for developing, testing, and applying analytical methods, and for studying physical properties of doughs, microscopic properties of cereal grains, and specialized engineering problems.

Ample office space, a department library, and a conference room are included in the new facilities.

One corner of the new baking laboratory. Because the Department is unique, students come from all continents to obtain advanced degrees here.

A Long and Honorable History

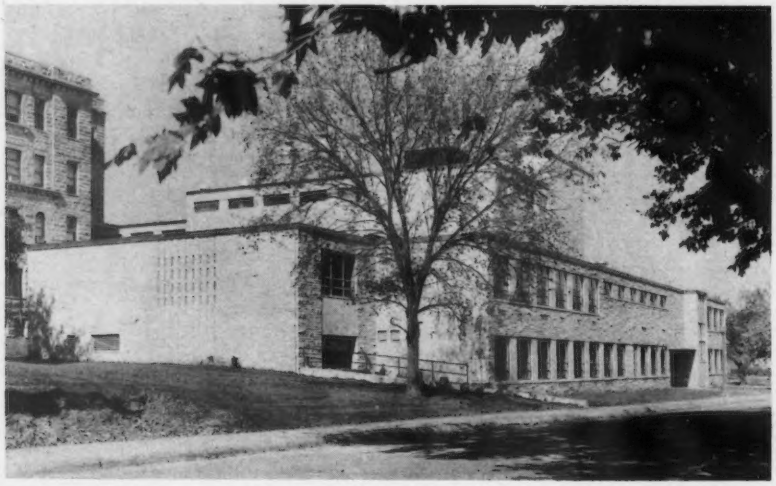
The Department of Flour and Feed Milling Industries is the most recent phase of work long in progress at Kansas State University. Testing of wheat varieties was under way before the Kansas Agricultural Experiment Station was founded under the Hatch Act in 1887. Milling and baking tests on wheats have been made since 1906, first in the Departments of Chemistry and Domestic Science, and later in the Department of Milling which was established in 1910 with Professor L. A. Fitz as Head. A pilot flour mill was first operated in 1914. Modern equipment for pilot-plant baking and for research in all phases of cereal chemistry was gradually acquired over the years to make the Department efficient and effective in both teaching and research.

In 1951, a request by the formula feed industry led to the establishment of a feed technology curriculum and the addition of facilities for teaching and research in this comparatively new field. The Department then acquired its present name.

A disastrous fire on August 25, 1957, destroyed most of the flour-milling equipment and nearly all teaching and research facilities, with a loss of $1.5 million. As this is being written, equipment is being installed in the new pilot mill, pilot bakery, and other instructional and research laboratories in the new building, which is to be dedicated May 18, 1961.

Since the fire, it has been necessary to discourage many graduate students, because the temporary facilities for research were strictly limited. With the new quarters available, it will now be possible to accept all qualified students who want to obtain advanced degrees in the various phases of milling technology and cereal chemistry.

New quarters of the Department of Flour and Feed Milling Industries. The pilot flour mill rises in rear right center. The feed mill is nearly hidden at left.



The Products of Research

Professor Fitz, Head of the Department from 1910 to 1923, and Dr. C. O. Swanson, Head from 1923 to his retirement in 1942, early established the reputation of the Department as a leader in research in the cereal grains field. This leadership has continued under the guidance of Dr. E. G. Bayfield (1942–1945) and Dr. J. A. Shellenberger (1945–date). Studies in the fields of wheat conditioning, effects of harvesting factors on wheat quality, protein and ash content of flour in relation to particle size, flour bleaching, impact milling, and sanitation have led to practical advances in the milling industry. Investigations in the field of grain storage, including determination of the retention of fumigants and de-

(Please turn to page 173)

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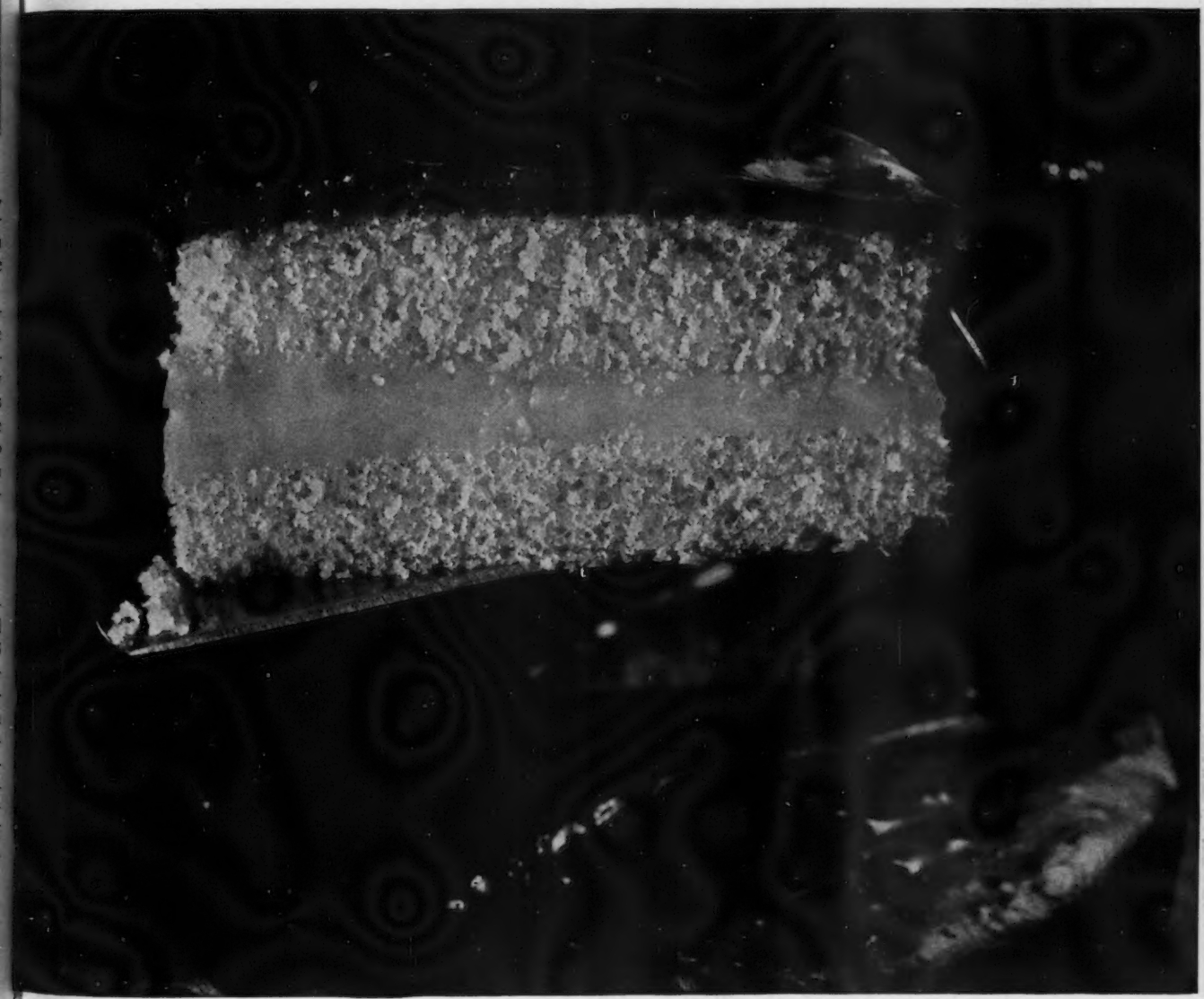

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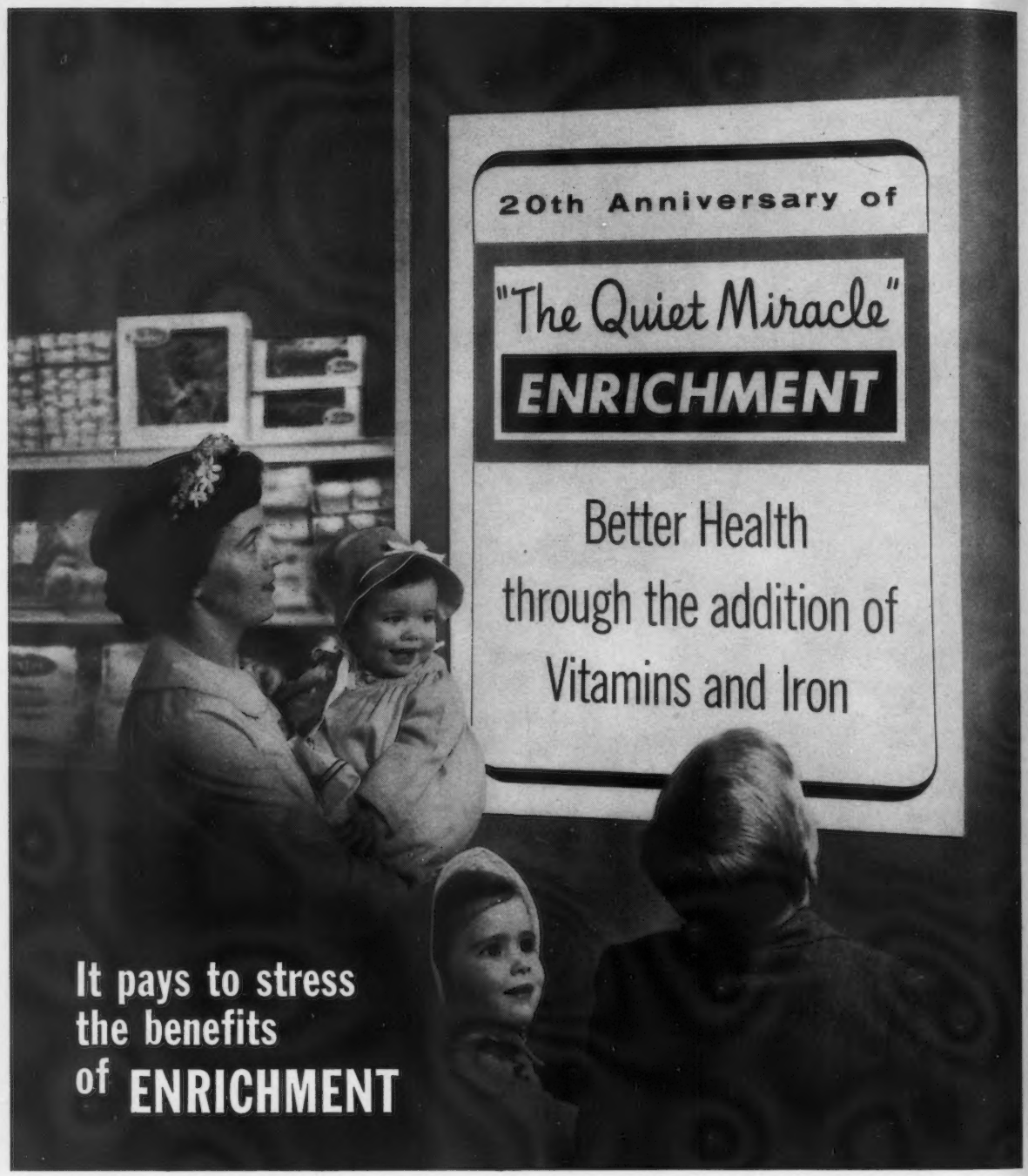

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People, Products, Patter

John T. Buckheit appointed manager of technical service department, Fleischmann Division, Standard Brands Sales Co.

Howard A. Clark, Standard Brands, Inc., retired March 31.

Donald R. Coles joins Kitchen Art Foods as director of Research, Development, and Quality Control, succeeding **Edward Feigon,** who resigned recently. Mr. Coles has been in similar work with The Pillsbury Co. and Gilster Milling Co.

Albert O. Daniels appointed as special sales representative, Fries & Fries Inc., in New York City; from positions with R. D. Webb & Co., Inc., and W. J. Bush & Co. for nearly 20 years.

Robert O. Davison elected vp, Kelco Co., manufacturers of refined algin products; has been with the company since 1934, and will continue as manager of its eastern division, with headquarters at Clark, N.J. Kelco supplies the natural extractives from giant kelp of California coastal waters to food, paper, drug, brewing, textile, and chemical industries.

A. L. Elder appointed first Director of new Institute of Nutrition, just established by Corn Products Co. **Neal E. Artz** appointed Assistant Director (is Assistant Research Director of CP). **Dorothy Rathmann** and **Louise Morrow** appointed to Institute's professional staff.

Rudy H. Ellinger appointed to staff of Durkee Famous Foods' technical service laboratory, Chicago; from director of research and quality control for J. D. Jewell, Inc., Gainesville, Ga., and previously with The Pillsbury Co. at Louisville, Ky., and Minneapolis.

Sven Hagberg, noted cereal chemist of Stockholm, Sweden, and a frequent contributor to THIS JOURNAL and to CEREAL CHEMISTRY, died February 28. He was chief chemist and head of the laboratories, Statens Hantverksinstitut. The National Swedish Institute for Trades and Handicrafts announces that it will build up a foundation in his name.

Harry Gehman named director of research, Corn Products Co.'s George M. Moffett Laboratories; will be in charge of all research at the Argo, Ill., laboratories. **Earl R. Kooi** appointed assistant director of research.

Kenton L. Harris reassigned to Bureau of Biological and Physical Sciences, U.S. Department of Health, Education, and Welfare, Food and Drug Administration, as assistant to the director, from deputy director, Division of Microbiology, FDA. Will coordinate and evaluate the Bureau's regulatory operations and assist in preparation of scientific evidence for trials. He will also assist in developing orientation programs for new personnel and specialized training programs for the scientific staff. Has been with FDA since 1937, working on problems of insect and rodent contamination of foods, with special emphasis on cereals and cereal grains. He organized the AACC's very successful training course on insect fragment identification.

Harold L. Janovsky appointed technical director, Florasynth Laboratories, Inc., a newly created position; he was formerly head of Fritzsche Bros., Inc., Flavor Laboratories. He is known for varied industry affiliations, technical articles, and lectures on food and flavor technology.

Robert B. Koch appointed principal research scientist at Honeywell Research Center, Minneapolis-Honeywell Regulator Co., Hopkins, Minn.; formerly chief of chemistry and microbiology branch, Quartermaster Food & Container Institute.

Kinnon Lilligren joins staff of General Mills Research Laboratories, in newly established position of manager of administrative services.

Raymond C. Long receives this year's scholarship of $300, awarded by Standard Milling Co. to the outstanding Kansas State University senior studying cereal crop improvement.

Robert M. McKinstrie died at his home in Roanoke, Virginia, in March. He was with Roanoke City Mills in that city, and was a member of Cincinnati Section, AACC.

Max C. Markley recently back from a tour of Honduras, Guatemala, and El Salvador, as consultant to flour mill owners; one of frequent trips, each lasting about 3 weeks.

J. W. Montzheimer, a charter member of Pacific Northwest Section, AACC, appointed chief chemist for General Milling Corp. in Cebu City, Philippines. This follows his retirement (April 1) after 37 years as chief chemist at Centennial Mills, Inc., Spokane. The Montzheimers are looking forward to this experience and the opportunity for some travel in the Orient. **A. J. Shogan,** PNW Section chairman, succeeds to the position as chief chemist for Centennial Mills.

Emil M. Mrak receives the Babcock-Hart Award for 1961, given in recognition of outstanding technological contributions which directly affect the nutritional well-being of the public. It is donated by The Nutritional Foundation and administered by the Institute of Food Technologists—an honorarium of $1,000 and an engrossed plaque. Dr. Mrak has been particularly concerned with research on the effects of various food processing techniques on the activity of yeasts.

Luther S. Roehm elected vp-marketing, Merck Chemical Division; will be responsible for marketing and development activities for the company's products serving the agricultural, medicinal, food, and industrial markets. He was

formerly a vp of A. E. Staley Mfg. Co.

Earl K. Spotts appointed general production manager, Arnold Bakers, Inc., Port Chester, N.Y.

Betty Sullivan, vp and director of research, Russell Miller-King Midas Mills, named chairman of USDA Grain Research and Marketing Advisory Committee. Elected vice-chairman was **Dallas E. Western,** director of grain development and agricultural relations, Quaker Oats, Chicago.

William E. Thompson appointed director of research, Archer-Daniels-Midland Co., Minneapolis; formerly director, chemistry and chemical engineering, at Southwest Research Institute, where he headed large-scale research program on a new method of encapsulation, and development of chromatographic techniques.

• • • Products

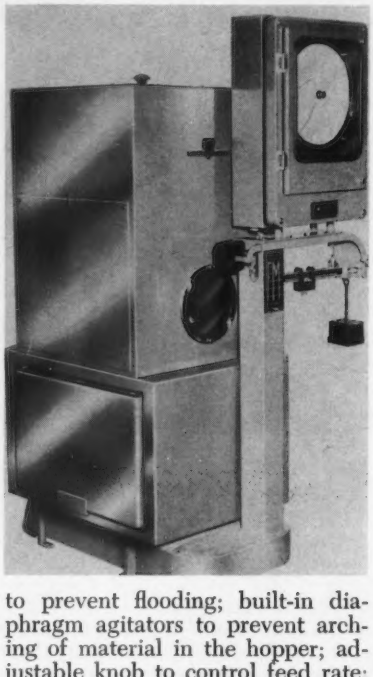
Cake mixes for bakeries. Five cake mixes and three cake bases have been introduced under the name "Baker's Best" by The Pillsbury Co. They represent a major reformulation in which Turbo-Milled cake flour has been incorporated in a high-ratio shortening combination. According to a spokesman for Pillsbury's bakery division, the formulations combine good eating qualities and tenderness with sufficient durability for the cake to withstand normal handling and packaging. They were made possible through the development of Turbo-Milled cake flour.

• • •

New formula for "FloxAid." Merck Chemical Division announces a new, more concentrated formula for "FloxAid" with increased solubility, permitting use in standard automatic water proportioners, which medicate 1 oz. of concentrate per gal. of water. Other features include: a new carrier that employs sucrose; formula contains penicillin in two forms; convenient package – 5⅓-oz. plastic bag – designed to medicate 50 gal. water at higher recommended dosage level; higher vitamin K and higher content of antibiotics at use level. The new "FloxAid" comes in 5-lb. drums containing 15 plastic bags, and 25-lb. drums containing 75 bags.

• • •

Recording dry feeder. A volumetric chemical feeder newly adapted for loss-of-weight recording has been released by Wallace & Tiernan Inc. (see photo). As described, the scale-mounted feeder (Series A-690) controls dry-chemical flow precisely and provides permanent records of feeder operation. Other features pointed out by the manufacturer: uniform delivery at rates between 0.0045 and 2.8 cu. ft. per hour; screw-type feed section



to prevent flooding; built-in diaphragm agitators to prevent arching of material in the hopper; adjustable knob to control feed rate; flashing light to indicate proper operation; direct-reading register to show amount of material in hopper at any time, and visual alarm to indicate hopper depletion. Amount of chemical fed during any desired period is read from 24-hour or 7-day charts. For more information, write Wallace & Tiernan Inc., 25 Main St., Belleville 9, N.J.

• • •

• • • Patter

Industrial award. Discovery and refinement of "ProTen," an antemortem injection of a highly refined papain solution, earned for Swift & Co. the Food Technology Industrial Achievement Award from the Institute of Food Technologists (IFT). The judges include six nationally known food technologists employed by academic or nonprofit organizations, and three representatives of nonrelated commercial food industries. Swift's contribution proved to be an outstanding food process representing a significant advance in the application of food technology to food production.

The product resulting from the "ProTen" process is a meat carcass containing uniformly distributed levels of the enzyme papain, so designed as to produce a tender cooked meat item when subjected to standard cooking temperatures.

As winner of the Award, Swift will be presented with a large bronze plaque at the 21st annual meeting of IFT, May 7-11, at Statler Hilton Hotel, New York City.

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Feed microscopists' convention. For the 1961 annual meeting of the American Association of Feed Microscopists in Denver, June 19 through 21, some interesting trips have been planned, along with formal meeting activities. A few of the topics to be covered in the formal presentations are: "Identification of Other Green Plants in Alfalfa"; "Use of Home-Made Photo Micro Equipment"; "Problems of the Feed Industry in Israel"; "Microscopy and Structure of Economically Important Foods and the Effect of Processing"; "Toxicology of Farm Animals," and many others. A workshop session is also planned.

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Annual field day at KSU. On Thursday, May 18, Kansas State University will hold its annual wheat field day and will dedicate the new wing constructed for its Department of Flour and Feed Milling Industries. The wing replaces facilities destroyed by fire in 1957. Installation of new equipment is not yet completed and student instructional facilities will not be ready until next fall, but some of the offices and research laboratories are already in use. The facilities will include pilot-plant equipment for flour milling, formula feed manufacturing, and baking.

A special train will bring industry representatives from Kansas City to participate in the dedication and field day events. Secretary of Agriculture Orville L. Freeman has accepted an invitation to deliver a major address.

Delegations representing the grain trade and the milling, baking, and feed industries are expected to attend. These groups have contributed equipment valued at $250,000, plus some $280,000 in cash, to assist in restoration of the flour and feed milling facilities.

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Rice utilization conference. Progress in rice utilization research will be the subject of a USDA-sponsored conference in Albany, Calif., May 18 and 19. The program will include research reports on improved milling of rice, chemical and physical research related to

product quality, and new processes and products. Speakers will be research workers from universities and commercial laboratories and from the Western and Southern URDD's. These two USDA divisions are jointly sponsoring the conference, which will be held in the Western Regional Research Laboratory, 800 Buchanan St., Albany. Programs and reservations are available on request.

• • •

Givaudan conference. All U.S. and Canada sales personnel of Givaudan Flavors Inc. were welcomed at a four-day February sales meeting in New York City, by members of the executive and marketing staffs of the company. The conference included an all-day visit to the plant at Delawanna, N.J., where new techniques and modern production facilities were demonstrated. During the program the operations of the firm were reviewed and emphasis was placed on the services available to American firms with foreign branches.

The company's development program for the flavor-using industries was reviewed, with particular attention to aerosol foods, an area to which Givaudan has devoted considerable research. Trends in food development and flavor requirements to meet new demands were discussed. A banquet brought the sessions to a close.

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Operative Millers meet. Members of the Association of Operative Millers from Districts 1 and 2 and the American Association of Operative Millers held a joint meeting at Kansas State University, Manhattan, April 7 and 8, beginning with social hour, dinner, and entertainment on Friday evening.

On Saturday morning's program, Fred Huttie, Jr., manager of Southwestern Department, The Mill Mutuals, talked on "Fighting Fires in Country Elevators"; Arlin Ward, Milling Research Department, The Pillsbury Co., on "Methods for Determining the Milling Values of Wheats"; Irvin L. Reis, head of the K-State Department of Industrial Engineering, "Quick and Dirty Industrial Engineering for Millers"; W. R. Wichser, manager of milling development, The Quaker Oats Co., "Experiences in Corn Milling"; and E. P. Farrell, K-State Flour and Feed Milling Department, "Flow and Arrangement of the K-State Mill." A luncheon on Saturday concluded the session.

Flour & Feed

FROM PAGE 168

termination of the causes of sick wheat and of spontaneous heating of stored grain, have been equally valuable.

In the area of baking technology and wheat quality, the Department makes a major contribution in its supervision of varietal wheat quality. Studies made here have contributed significantly to the development and application of fungal enzymes in baking, and have provided formulas and techniques for the use of honey and other sweetening agents in the bakery field. Valuable information has been developed on the chemistry and microbiology of pre-ferments as applied to baking, and on the nature of the flavor constituents of bread.

Recently a major contribution was made by the Department in the area of the pathogenic resistance of the wheat plant, a field but little explored up to this time. The physiology and biochemical involvement of the Hessian fly in damage to wheat in the field was considerably clarified by this work.

Although the Department entered the field of feed technology relatively recently, here, too, it has made significant contributions. Published studies on the mixing of microingredients, methods of incorporating phosphoric acid in feeds, techniques for the utilization of fat in pelleted rations, and methods for pelleting sorghum grain have proved valuable to the feed industry.

During 1956 through 1960, over 180 scientific articles, station bulletins, and circulars were contributed by Department members.

What Lies Ahead?

With the new facilities now available, student enrollment is expected to reach and probably surpass 200. A milling short course, as a service to the flour-milling industry, is currently being contemplated.

The program in testing of wheat quality and that in fundamental and applied research will be intensified. Some lines of work to which special attention will be given include:

Thorough, careful testing of new wheat varieties for the Southwest, to ensure maximum milling and baking qualities;

Studies of long-term storage of flours;

Study of residual insecticides;

Determination of the effect of radioactive material on wheat processing;

Investigation of the basic biochemical and physiological factors influencing wheat quality;

Elucidation of the effect of environment on varietal differences in the quality of hard red winter wheat;

Determination of factors which affect the colloidal properties of dough;

Development of improved bread flavors as a means of increasing flour consumption;

Continuation of fundamental studies of the biochemical factors involved in the resistance of the wheat plant to insect attack;

Determination of the factors affecting the production of protease and alpha-amylase in malted wheat and other malted grains;

Development and testing of rapid inspection methods for the determination of insect and rodent contamination in wheat and other cereal grains and in their products;

Study of the fundamental biochemical and physiological processes involved in the deterioration of stored grains;

Micromeasurements of physical properties of kernels of cereal grains;

Determinations of the effects of conditioning methods on milling performance of hard red winter wheats; and

Investigations on the structural characteristics affecting milling properties of hard red winter wheats.

Now that the staff, which has been productive even during the period of deprivation resulting from the fire, is moving into adequate quarters, the future of the Department of Flour and Feed Milling Industries can only be envisioned as one of great promise.

the President's Corner

news of the association

MINUTES OF THE ANNUAL BUSINESS MEETING

Baker Hotel, Dallas, Texas, April 13, 1961

President Johnson opened the meeting at 11:40 a.m. Secretary Pence moved that the minutes of the previous meeting be approved and accepted as published in the May, 1960, issue of CEREAL SCIENCE TODAY. Howe seconded and the motion carried. President Johnson then reviewed actions taken by the Board of Directors at their three meetings of the preceding year and by correspondence. These actions included institution of affiliations with the American Society of Association Executives on behalf of Ray Tarleton, our Executive Secretary, and the International Association for Cereal Chemistry. Dr. John A. Shellenberger will be our delegate to the annual meet of this Association in Vienna during the month of June. Through the assistance of the Millers' National Federation, financial assistance to pay travel expenses for Dr. Shellenberger was obtained from the Foreign Agricultural Service of the U.S. Department of Agriculture.

Other actions of the Board included establishment of the W. F. Geddes Memorial Award to recognize distinguished service to the Association on an annual basis. Special commendations were issued to the members of the Physical Testing Methods Committee for their conduct of the Farinograph Training Workshop and the farinograph standardization program adopted by the Board. Steps were taken to establish a Cereal Chemists' Memorial Foundation to provide means to memorialize the passing of our members as time goes on. A study of the professional status of cereal chemists was begun. New York City was selected as the convention city for 1966. In closing his report, Dr. Johnson publicly acknowledged the excellent sustained acomplishments of Ray Tarleton, Executive Secretary, on behalf of the Association. Doty moved acceptance of this report, Longshore seconded, and the motion carried.

Previously printed reports of the Treasurer, Executive Secretary, and Editors of Association journals were approved in the form they appeared in the April, 1961, issue of CEREAL SCIENCE TODAY. Ramstad moved for this acceptance, and Downes seconded. Kenton L. Harris moved that all reports of the technical committees and the methods to appear in the seventh edition of *Cereal Laboratory Methods,* as submitted to the Methods Revision Committee, be accepted for first approval except as specifically proposed for final action by a specific technical committee. Christensen seconded and the motion carried. Harris also moved that published reports of all nontechnical committees except the By-Laws Revision Committee be accepted. Bequette seconded, and the motion carried.

Sherwood reported for the By-Laws Revision Committee and reviewed in detail the specific amendments recommended and the purpose of such revisions. He also called specific attention to two minor typographical errors in the copies of the amendments which had been circulated to the membership prior to the current meeting. Sherwood moved, and Miller seconded, that the suggested By-Laws amendments be approved as corrected. After some discussion with reference to desirability of the proposed classification of Associate Membership, the motion carried with only one discernible negative vote. (An attendance of approximately 200 at the meeting more than provided a quorum.)

Zeleny moved for acceptance of his report from the annual Meeting of the Agricultural Research Institute as it was printed in the January, 1961, issue of CEREAL SCIENCE TODAY. Christensen seconded the motion, and it carried. Brooke moved for acceptance of his report from the annual meeting of the American Association for the Advancement of Science as it appeared in the March, 1961, issue of CEREAL SCIENCE TODAY. Doty seconded; motion carried.

Local Arrangements chairman for 1961, Hugh Fetty, reported that registrations for the meeting totaled 533 members and nonmembers and 125 ladies, making a total of 658. Program Chairman Miller also indicated that the convention had been quite successful from the program point of view. The report of the Resolutions Committee was rendered by Aitken who also moved for its acceptance. Morck seconded, and the motion carried.

As there was no further old business and no new business to come before the meeting, outgoing President Johnson installed incoming President Evans by transmitting the gavel to him. Evans then asked for a motion to adjourn. Morck so moved, Gilles seconded, and the meeting adjourned at 12:10 p. m.

Respectfully submitted,

JAMES W. PENCE, *Secretary, AACC*

REPORT OF RESOLUTIONS COMMITTEE

WHEREAS, The American Association of Cereal Chemists has, this day, concluded its 46th Annual Meeting, we record our gratitude and indebtedness to all who have so untiringly given of their time and effort to the Association's activities throughout the year just ended. Special tribute is paid to President Johnson, President-Elect Evans, and the other officers of the Association.

Our thanks are also extended to Program Chairman Byron S. Miller and his committee; to Local Arrangements Chairman Hugh Fetty and his committee; to Mrs. Donald Hatch and Mrs. Hugh Fetty and the Ladies' Entertainment Committee; and to Kenton L. Harris and O'Dean Kurtz of the Exhibits Committee.

whose untiring efforts have made this meeting an outstanding success.

This meeting could not have gone the way it has without the complete co-operation of the host hotel and the numerous Allied Trades organizations, to whom we extend our heartfelt thanks and commendation.

We also extend our appreciation to our guest speakers and to all those who contributed papers.

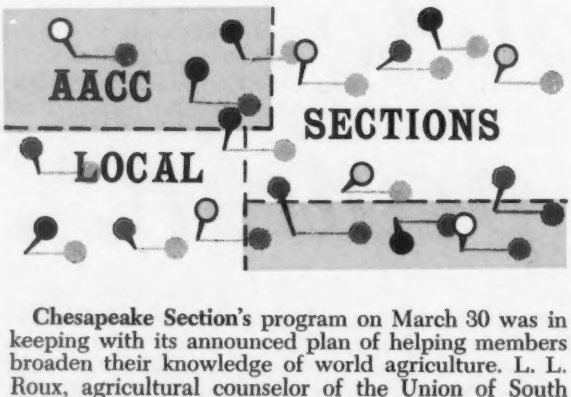
Special mention is made of the contribution of Kenton L. Harris who, through his work as Chairman of the Technical Policy Committee, has added immeasurably to the reputation of the Association.

To the late W. F. Geddes, and his successor Kenneth A. Gilles, editors of CEREAL CHEMISTRY; to Paul E. Ramstad, editor of CEREAL SCIENCE TODAY; and to Ray Tarleton, Executive Secretary, we extend our sincere appreciation for their continuing efforts in their respective offices.

We record, with deep regret, the loss of the members of our Association who died during the past year.

BE IT RESOLVED, that these tributes be recorded in the Association, and that the Secretary be instructed to transmit these expressions to all concerned.

T. R. AITKEN, *Chairman;* H. H. FAVOR,
May 13, 1961 and J. A. MCHUGH



Chesapeake Section's program on March 30 was in keeping with its announced plan of helping members broaden their knowledge of world agriculture. L. L. Roux, agricultural counselor of the Union of South Africa, spoke on the conditions and problems of agriculture in his homeland, with many colorful slides.

Speaker for the April 27 meeting was O. Silberstein, chief of the department of food technology, Wallerstein Co.: "The Present and Future Status of Enzymes as They Are Applied in the Baking Industry." Dr. Silberstein's work and interests cover all applications of enzymes to the food industry. The meeting was held at Binder's Midway Restaurant, near the Agricultural Research Center, Beltsville.

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Canadian Prairie Section met February 28 in the Grain Exchange Board Room, Winnipeg. Barney Peterson, plant pathologist, discussed "Certain Plant Diseases and Their Effect on Human Relations."

For the March 21 meeting, Gordon Grosh of Fairway Milling Co. spoke on "Problems of Particle Size Analysis." After reviewing the methods now in use and discussing their pros and cons, he presented a practical approach to particle size analysis and results of methods recently tried by himself and associates at Detmold, Germany. He also outlined a new simplified method of analysis.

The April meeting was held at Labatt's Winnipeg Brewery; the program included a film by the National Film Board entitled "Interview with Linus Pauling."

New officers: chairman, L. N. Rennie; vice-chairman, R. Tkachuk; secretary-treasurer, Miss K. Wach.

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Northern California Section met on March 22 for dinner at Zombie Village, Oakland. John E. Blum of Durkee's Famous Foods conducted a plant tour of the company's facilities, and afterward held an informal question and discussion period.

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Southern California Section met on March 7 in Los Angeles. Bob Burns of Wallace & Tiernan (Los Angeles) talked on the chlorination of wheat wash and tempering water as related to the milling industry. Chlorinating, he said, reduces the bacteria count in the wheat and hence the chance of rope in the baked goods.

The picnic committee reported on plans for the spring picnic to be held on June 24 at Newport Dunes Aquatic Park.

Theodore Earle, speaker for the April 4 meeting, discussed his process of extracting invert sugar and removing the wing from the wheat kernel. Using his method, he showed how he was able to increase the yield of patent flour recovered.

Business meeting followed the dinner.

The final meeting of the 1960-61 year is scheduled for May 2 at the Rodger Young Auditorium, Los Angeles, with an interesting and unusual film to be shown by the Ralston Purina Co., "The Rumen Story." The film shows the bacterial digestion that takes place inside a cow's stomach. Local Section members who attended the national convention in Dallas will report on the technical sessions and business meeting.

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New York Section's speaker on March 24 was Franklin M. Depew, president of the Food Law Institute, who brought information relating to the Food Additives Amendment of 1958. He said that although the bill technically became effective on March 7, 1961, on that date "indications were that it would be amended to give the Administration discretionary authority to extend until June 30, 1964, the deadline for proving the safety of any substance for which an application for extension or petition to establish safety has been filed prior to March 6, 1961." He added the bill had been approved "with these amendments . . . and passed the House in this form today" (March 24).

George T. Carlin, associate director of research, Swift & Co., spoke at the April 4th meeting on "Eggs in Baked Products." He outlined the physical and chemical composition of eggs and their properties and uses, both in frozen and dried form, in the production of cakes, doughnuts, and prepared mixes. A constantly increasing demand for high-quality frozen eggs on a year-round basis, he said, has led to vast improvements in their processing. With better methods of drying and sanitation, equally great strides are being made with dried eggs. He sees a definite need in the industry for setting up a basic nomenclature and set of standards for these products.

New officers, 1961–62: chairman, Roland A. Morck; vice-chairman, John T. Buckheit; secretary-treasurer, Stanley A. Bobrowski, Jr.

The financial report showed 151 paid-up local members, of whom 130 are also members of the National Association.

Northwest Section's meeting on February 16 had as speaker Irvine Liener, University of Minnesota, on "The Nutritional Aspects and Toxic Principles of Soybeans." Dr. Liener reviewed past work leading to the present research on amino acids and the inhibiting factors.

At the March 15 meeting, C. M. Hollenbeck, Wisconsin Malting Co., spoke on "The Reaction of Malt during Baking" and related topics regarding malt. Dr. Hollenbeck included a discussion of malt production through its effect in bread doughs.

New officers were elected for the 1961-62 season: Ray Anderson, chairman; Sheldon Greenberg, vice-chairman; Ralph H. Durr, secretary; Eugene Guy, treasurer. It was suggested that from money in the treasury an annual W. F. Geddes Award be established.

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Central States Section was host on March 17, at Gatesworth Hotel, to AACC National President John A. Johnson, who discussed his recent findings on the flavor of bread, and brought members up to date on Association affairs.

New officers elected were: Marvin Byer, chairman; Robert Seeley, vice-chairman; James Conn, secretary-treasurer.

The next meeting is to be held on June 24.

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Cincinnati Section held its spring meeting on Friday, March 24. An outstanding program included a plant tour of the Westinghouse manufacturing facilities at 9:15 a.m., and luncheon at the Nationwide Inn with C. H. Braley of the American Red Cross as speaker.

On the technical program, John Litchfield (Battelle Memorial Institute) spoke on "Food Uses for Microorganisms," indicating yeasts, mushrooms, and algae as possible food sources but, at present, only as emergency foods or supplements.

Don K. Dubois (Hercules Powder Co.) demonstrated, using slides, that many benefits can be realized in bakery products by substituting wheat starch, "Starbake," for some of the flour. He pointed out these improvements to be realized in layer cakes: 1) better cake quality; 2) better flexibility of the flour used, through (a) quality control, (b) simplifying the special flour inventory, and (c) facilitating the handling of bulk flour.

Chairman Harry Loving concluded the program with a paper, "Trends in Milling and Distribution of Bulk Flour." He stressed that bulk loading has not reduced the need for help in mills, and the increased cost of bulk-loading tanks, air-loaders, etc., can be paid off in 2½ to 3 years of operation. Damaged shipments are very few with bulk flour, he said.

New officers are: chairman, Lester J. Brenneis; vice-chairman, Don K. Dubois; secretary-treasurer, Thomas H. McCormack.

New members: Oliveanna Baumer, Maumee, Ohio; John Corbishley, Hercules Powder, Harbor Beach, Mich.; Robert Dowdle, HumKo Products, Memphis, Tenn.; Gerald H. Ingraham, The Pillsbury Co., Hamilton, Ohio; Joseph Roshone, Cincinnati.

The next meeting will be held October 20 and 21 at Danville, Ill., jointly with Districts 3 and 5, A.O.M.

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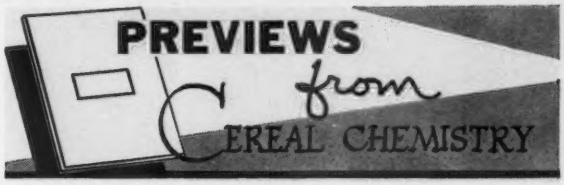
Midwest Section's program for the April 3 meeting consisted of a symposium on the subject of "What's New in Products from the Soybean," chairmaned by D. W. Johnson, Chemurgy Division, Central Soya Co. The meeting began at 4:00 p.m. and continued after dinner. The program opened with "Composition and Nutritive Properties of Soy Products" – Gleason Diser, Archer-Daniels-Midland. Under "Soy Proteins and Protein Concentrates and Other High-Protein Products," Alan Smith, NURDD, discussed "Isolation and Chemical Characteristics" and Robert Gunther, Gunther Products Co., handled "Applications." Further subjects were "Soy Lecithin – Chemical and Physical Characteristics and Uses" – Herbert Iveson, Central Soya; and "Soy Flour and Meal – Composition, Characteristics, and Uses" – Milton Dippold, Spencer Kellogg Co.



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Flavor of Bread and Pastry upon Addition of Maltol, Isomaltol, and Galactosylisomaltol. J. E. Hodge and Helen A. Moser, Northern Regional Research Laboratory, Peoria, Ill.

Preparation and Properties of Galactosylisomaltol and Isomaltol. J. E. Hodge and E. C. Nelson, Northern Regional Research Laboratory, Peoria, Ill.

The Carbohydrates of the Gramineae. IX. The Constitution of the Water-Soluble Polysaccharides Derived from Bread Crumb. Kenneth A. Gilles, North Dakota State University, Fargo; W. F. Geddes and Fred Smith, University of Minnesota, St. Paul

Bubble Mechanics in Thick Foams and Its Effects on Cake Quality. Avrom R. Handleman, James F. Conn, and John W. Lyons, Monsanto Chemical Co., St. Louis, Mo.

Modified Wohlgemuth Methods for Alpha-Amylase Activity of Wheat and Rye. Sven Hagberg, Statens Hantverksinstitut, Stockholm 4, Sweden

Characterization of Intermediary Fractions of High-Amylose Corn Starches. Roy L. Whistler and William M. Doane, Purdue University Agricultural Experiment Station, Lafayette, Indiana

Proteins of Wheat and Flour. Extraction, Fractionation, and Chromatography of the Buffer-Soluble Proteins of Flour. J. H. Coates and D. H. Simmonds, University of Adelaide, Adelaide, South Australia

The Oxidation of Wheat Flour. I. Measurement of Sulfhydryl Groups. Betty Sullivan, Leland Dahle, and Elof Larson, Russell Miller-King Midas Milling Co., Minneapolis, Minn.

The Oxidation of Wheat Flour. II. Effect of Sulfhydryl-Blocking Agents. Betty Sullivan, Leland Dahle, and O. Rudolph Nelson, Russell Miller-King Midas Milling Co., Minneapolis, Minn.

Note on a Method of Determining the Degree of Milling of Whole Milled Rice. Joseph T. Hogan and Harold J. Deobald, Southern Regional Research Laboratory, New Orleans, Louisiana.

Communication to the Editor. Obtaining Damaged Starch Mathematically Rather Than Graphically by the Sandstedt and Mattern Procedure. J. G. Ponte, Jr., and Jocelyn Rosen, Continental Baking Co., Rye, N. Y.

No, But She Knows What She Likes! Somehow she could never bring herself to try snails. But she's famous for her chicken fricassee and dumplings. Tasty food is important to her. To her? To everybody. The public stays stubbornly away from foods that miss on flavor. The public stays stubbornly loyal to foods that are flavored by Felton! Why? Because Felton works with all the standard ingredients of flavor plus one: creativity. This flavor creativity makes taste buds flower to their fullest satisfaction; develops steady customers, steadily growing sales. Send for the man from Felton. He'll put this creativity to work for you! Felton Chemical Company, Inc., 599 Johnson Ave., Brooklyn 37, N.Y.

Felton

LETTERS to the editor

Soybean Exports

DEAR SIR:

We should like to call your attention to an article, "Market for Soybean Surplus," on page 136 of the April 1961 issue of CEREAL SCIENCE TODAY.

In the first place there is not now and never has been a soybean surplus. All the soybeans we produce can be marketed either domestically or in world markets above support prices.

Secondly, the statement is made that we export 350 million bushels of soybeans to Japan annually. Actually the *total* exports of soybeans to all countries is only slightly in excess of 100 million bushels and only a small fraction of this to Japan.

Just to keep the record straight.

Grain Processing Corporation
Muscatine, Iowa

FRANK J. PROCHASKA
Vice-President

New AACC Members

AMSZ, JOE, JR., *Technical Sales Representative,* Red Star Yeast & Products Company, 221 E. Buffalo St., Milwaukee, Wisconsin.

ACORD, JOHN E., *Chemist* (Montana Flour Mills), 421 W. Beall, Bozeman, Montana.

ANG, ANDRES, *Chief Chemist,* Wellington Flour Mills, Shaw Blvd., Pasig, Rizal, Philippines.

BERMUDEZ, ROBERT E., *Technical Sales Representative* (Kelco Company), 1904 Mashie Drive, St. Louis 14, Missouri.

CLUSKEY, JAMES E., Northern Utilization Research & Development Division, 1815 N. University, Peoria, Illinois.

COLSON, DONALD L. (The Pillsbury Company), 2409 Johns Road, Springfield, Illinois.

DIBBLE, WILLIAM E., *Manager,* Product Research, Interstate Bakeries Corp., 12 E. Armour Boulevard, Kansas City 11, Missouri.

EICHENBERGER, WM. R., *Head, Food Section,* A. E. Staley Mfg. Co., Decatur, Illinois.

EMERY, DONALD F., *Section Leader, Food Development Dept.,* General Mills Central Research Labs, 2010 E. Hennepin Avenue, Minneapolis 13, Minnesota.

FIRMENICH AND COMPANY, 250 West 18th Street, New York 11, New York. Attn: Charles H. Milton.

FISCHBACH, EUGENE, DCA Food Industries, Inc., 45 West 36th Street, New York 18, New York.

FOGEL, NORMAN W., *Quality Control Manager* (F. W. Stock Div.), 46 South Howell, Hillsdale, Michigan.

FRENCH, FRANKLIN D., American Bakeries Company, 919 No. Michigan Ave., Chicago 11, Illinois.

GARB, ROSA MARIA, New Jersey Flour Mills Co., Clifton, New Jersey.

HAHN, RICHARD R., (Harvest Queen Mill & Elevator Co.), P. O. Box 991, Plainview, Texas.

HARDWICK, WILLIAM A., Central Research Dept., Anheuser-Busch Inc., 721 Pestalozzi, St. Louis 18, Mo.

HASTINGS, WALDON H., Dept. of Flour & Feed Milling Ind., Kansas State University, Manhattan, Kansas.

HAYES, EDWARD R., Union Machinery Division of AMF, 2115 W. Laburnum, Richmond 27, Va.

HOLT, KENNETH E., *Director of Quality Control,* Archer-Daniels-Midland Co., 700 Investors Bldg., Minneapolis 2, Minn.

JOHNSON, FRANK E., (Igleheart Bros.), RR No. 4 Kuebler Rd., Evansville, Ind.

KISSEL, PAUL E., (American Foods), 1154 Oakleigh Drive, East Point, Ga.

KOHLER, GEORGE G. (Western Utilization R. & D. Div.), 2259 Tampalpais Ave., El Cerrito, Calif.

LIPKA, DAVID H., *Director of Food Development Lab.,* (DCA Food Industries), 28 Bradford Road, Plainview, L.I., New York.

LONGHOFER, RICHARD W., (Rodney Milling Co.), 1255 Plass, Topeka, Kansas.

MACDONOUGH, E. EVERETT, JR., Sterwin Chemicals, Inc., 1450 Broadway, New York 18, New York.

MAURER, JAMES J., International Milling Co., New Ulm, Minnesota.

MONTGOMERY, EDNA M., *Research Chemist,* Northern Utilization Research & Develop. Division, 1815 N. University, Peoria, Illinois.

MUELLER, WM. R., (W. E. Long Company), 138 S. Kenilworth, Elmhurst, Ill.

MURRAY, BEN A., *Supervisor, Quality Control* (The Nestle Company), 100 Bloomingdale, White Plains, New York.

NORRIS, CALVIN G., The Pillsbury Co. Research Labs, 311 2nd St. S.E., Minneapolis 14, Minn.

NORTH, RAY S., *Vice President,* Sethness Products Co., Keokuk, Iowa.

OVERSEAS MERCHANDISE INSPECTION CO., Rm. 703 Lewis Bldg., Portland 4, Oregon. Attn: Mr. Hidekazu Komuro.

PARKER, GORDON, Quaker Oats Company, 617 W. Main St., Barrington, Ill.

RADCLIFF, WM. A., *Quality Control Chemist,* (The Pillsbury Company), 1315 Mt. Curve Ave., Minneapolis, Minn.

ROACH, THOMAS A., Grain Inspection Office, 1st and Park, Fremont, Nebr.

SCHMALZ, CHESTER E., (Hercules Powder Co.), 8068 Sand Beach Rd., Harbor Beach, Michigan.

SULLIVAN, JOHN WM., (Kansas State University), 1216 Colorado, Manhattan, Kansas.

TENNEY, RALPH J., C. J. Patterson Co., 3947 Broadway, Kansas City 11, Mo.

VAUGHN, WM. M., (Victor Chemical Works), 4118 Travis, Apt. No. 103, Dallas 4, Texas.

VIDAL, FREDERICK, (Wallace & Tiernan), 25 Main St., Belleville, N. J.

VILLAR, HECTOR RODRIGUEZ, (Compania Molinera Santa Rosa Ltda.), P. O. Box 2716, Lima, Peru.

WALTER, R. D., *Division Sales Service Mgr.,* (Corn Products Company), 629 Rays Road, Stone Mountain, Ga.

WHITACRE, JAMES W., Grain Merchants, Inc., 352 N. Broadway, Wichita, Kansas.

WICK, EMILY L., *Assistant Professor*, Room 16-215A, Dept. of Nutrition, Food Science and Technology, Mass. Institute of Technology, Cambridge 39, Mass.

WILSON, LEN A., Consolidated Flour Milling Co., Winfield, Kansas.

• • • Germany

Following is the program for the annual conference of European cereal chemists, to be held in Detmold, Germany, on June 7 to 9, with several AACC members as guest speakers. (Other sections of the Association and their time of meeting are: Starch, April; Rice, May; Baking Industry, September; and Flour Milling, October.)

Basic Research on Grain

MUEHLENTHALER, E. (Zurich, Switzerland) – Electron microscope studies of the formation and structure of cereal and potato starch

SHELLENBERGER, J. A. (Manhattan, Kansas) – Histochemistry of the wheat kernel

CARLES, J. (Toulouse, France) – The carbohydrate-protein equilibrium during the life of the wheat plant

ROHRLICH, M. (Berlin, Germany) – The formation of protein during the maturing of cereals and the appearance of peptides

EIFRIG, U. (Muenster, Germany) – Physiological aspects of germination

GRAHL, D.; THIELEBEIN, M.; FISCHNICH, O. (Braunschweig, Germany) – Germinating power of cereals with special consideration of the dormant period

ROTHE-POTSDAM, M. (Rehbrucke, Germany) – Composition and role of plant oil

BURÉ, J. (Paris, France) – Report on scientific studies of bread by the National Center of Coordination of Studies on Nutrition and Feeds, November 1954 to 1960

Problems of Quality of Wheat and Durum

FAJERSSON, F. (Sweden) – Studies of quality differences in wheat with special emphasis on seasonal variations

WALTI, K. (Vienna, Austria) – Problems of wheat quality in Austria

VOELKER, L. (Giessen, Germany) – Effect of nitrogen fertilizers on protein composition of cereal crops

HAGBERG, S. (Stockholm, Sweden) – Rapid method for protein analysis in wheat and rye

IRVINE, G. N. (Winnipeg, Canada) – Rheological studies of durum semolinas

MENGER, ANITA (Detmold, Germany) – Studies of possible relationship between soluble carbohydrates in durum wheat and nonenzymatic browning

Flour Problems

MAES, D. E. (Brussels, Belgium) – Protein solubility and baking quality

ELTON, G. A. H. (Chorleywood, England) – Wheat protein and flour strength

PELSHENKE, P. F.; HAMPEL, G. (Detmold, Germany) – Starch retrogradation in different cereal products

BECKMANN, R. (Freiburg, Germany) – Cereal and grain products in infant feeding

Aromatic Components of Bread

PENCE, J. W.; KOHLER, G. O. (Albany, California) – Research in bread flavor by the U.S. Department of Agriculture

OCKER, H. D. (Detmold, Germany) – Gas chromatography of the aromatic constituents of bread and other bakery products

DREWS, E. (Detmold, Germany) – Decomposition of certain flour acids during fermentation of sour dough and the effect of addition of malic and citric acid on the lactic and acetic acid content of the bread

JELLINEK, G. (Giessen, Germany) – Flavor profiles as a new method of organoleptic analysis of cereal products

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Following are brief notes on the program of the 10th Annual Conference, Cereal Chemistry Group, Royal Australian Chemical Institute, held at Leura, N.S.W., October 10–15, 1960.

R. A. Bottomley (Mauri Bros. & Thomson Ltd.) gave the first paper: Observations on the Continuous Process of Breadmaking. Guest Scientist J. A. Anderson (Grain Research Laboratory, Winnipeg, Manitoba) conveyed greetings from the Chemical Institute of Canada and the AACC. He then reviewed lines of attack on the problem of understanding the physical properties and baking behavior of dough in terms of the chemistry and reactions of its constituents.

Further subjects and speakers: *The Wheat Grain – Growth Chemistry and Milling Problems:* B. J. Brooks – the importance of wheat classification to millers; A. C. Jennings – chemical changes, particularly those involving the substrates for and synthesis of starch and protein. *Protein Chemistry:* M. V. Tracey – enzyme systems; Wilson Lee – chemistry of minor constituents of flour; J. F. Williams – current concept of protein function as related to variation in structure; D. H. Simmonds – definition of the complex mixture of proteins present in wheat flour; B. M. Graham–theory and application of physical testing equipment. *Test Milling* was discussed. *Wheat Quality* included Testing Problems, Quality Aims, and A Breeder's Viewpoint.

Delegates visited the newly completed joint premises of the Bread Research Institute of Australia and CSIRO Wheat Research Unit. Topic at the official dinner was Wheat Marketing Problems. After the conference Dr. Anderson visited the Northwestern NSW wheat zone, and organizations in Melbourne and Sydney.


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